AN ANALYSIS OF THE ABILITY OF AN INSTRUMENT TO MEASURE QUALITY OF LIBRARY SERVICE AND LIBRARY SUCCESS

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This study consisted of an examination of how service quality should be measured within libraries and how library service quality relates to library success. A modified version of the SERVQUAL instrument was evaluated to determine how effectively it measures library service quality. Instruments designed to measure information center success and information system success were evaluated to determine how effectively they measure library success and how they relate to SERVQUAL. A model of library success was developed to examine how library service quality relates to other variables associated with library success.

Responses from 385 end users at two U.S. Army Corps of Engineers libraries were obtained through a mail survey. Results indicate that library service quality is best measured with a performance-based version of SERVQUAL, and that measuring importance may be as critical as measuring expectations for management purposes. Results also indicate that library service quality is an important factor in library success and that library success is best measured with a combination of SERVQUAL and library success instruments. The findings have implications for the development of new instruments to more effectively measure library service quality and library success as well as for the development of new models of library service quality and library success.

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CHAPTER I

INTRODUCTION

Overview of the Study

Despite the emphasis that most libraries place on service, there have been only a few studies that attempt to determine how to measure quality of library service from a user's perspective, and even less research into how the quality of library service provided relates to overall library success. As libraries face shrinking budgets, sweeping technological changes, and an uncertain future, it is critical for libraries to examine what service users expect or desire and what level of service contributes to library success. Traditionally, libraries have tended to gauge success in terms of organizational performance, such as the number of items circulated or the number of questions answered by the reference staff. The problem is such performance measures say nothing about quality from the customer's viewpoint (Hernon & Altman, 1996). Although there have been efforts to measure user satisfaction with library services, these were developed primarily to measure specific transactions, and few measurement tools have been developed to evaluate the overall scope of library service quality from the user's perspective (Nitecki, 1995). At the same time, while it is important to measure service quality, measuring service quality alone does not provide a thorough understanding of the total contribution of an information system to the organization (Myers, Kappelman, & Prybutok, 1997). However, apparently no instrument has been developed that incorporates perceived service quality as part of an overall measure of library success.

Several library studies have suggested the use of business or marketing tools to measure service quality within libraries and have focused on one instrument in particular called SERVQUAL (Hebert, 1993; Nitecki, 1995; White & Abels, 1995; Maddox-Swan, 1998), while others have recommended the development of instruments designed specifically for libraries (Hernon & Altman, 1996). There is no general consensus on how to measure service quality in libraries, or what type of instrument is best suited to measure library service quality. While it is tempting to adopt a tool that has been used in the business sector to measure service quality in libraries, a number of researchers have reported both theoretical and methodological problems with SERVQUAL (Babakus & Boller, 1992; Babakus & Mangold, 1992; Brown, Churchill, & Peter, 1992; Carman, 1990; Cronin & Taylor, 1992, 1994; Finn and Lamb, 1991; Teas, 1993, 1994). If SERVQUAL is used to measure library service quality, there needs to be more research into how to eliminate or reduce the problems associated with it.

Just as there is currently disagreement regarding what type of instrument should be used in libraries to measure service quality, there is a similar lack of consensus among researchers in how to measure library success. Although there have been important studies to identify measures of public library effectiveness (Van House & Childers, 1993), one approach that evidently has not been explored to any extent is to examine how success of information centers and information systems is being measured and apply similar methods to libraries. At the same time, it is important to examine what role service quality plays in library success. As libraries rush to embrace new technology and digitize their collections for network use, there is a tendency to overlook the importance that service continues to

play in the "virtual" environment. Little attention has been given to the nature and quality of library service that is required in the digital age (Ferguson & Bunge, 1997). While information quality and system quality may contribute to the success of libraries, the role of service should be included in any implementation of technology (Millson-Martula & Menon, 1995). SERVQUAL is examined in this study to identify how it should be used to measure library service quality and how it relates to an instrument that measures library success.

In 1988 Parasuraman, Zeithaml, and Berry developed a generic instrument to measure service quality called SERVQUAL based on input from focus groups. Although SERVQUAL was developed within the marketing sector, it has been used in a variety of organizational settings, including libraries and information centers (Coleman, Xiao, Bair, & Chollett, 1997; Hebert, 1993; Kettinger & Lee, 1994; Nitecki, 1995; White & Abels, 1995; Maddox-Swan, 1998). Parasuraman, Zeithaml, and Berry have made a number of changes to SERVQUAL since the instrument was first developed. Some of these changes were made to address problems other researchers reported with SERVQUAL. In 1994, Parasuraman, Zeithaml, and Berry investigated 3 different SERVQUAL formats and recommended that researchers use a format that separates expectation ratings into zones of tolerance.

Although library researchers acknowledge problems with SERVQUAL, little modification has been done to SERVQUAL by library researchers, and there has been no concerted attempt to examine changes to the format proposed by Parasuraman, Zeithaml,

and Berry in 1994. Several modifications to the 1994 format of SERVQUAL were made in this study in order to examine some of the problems associated with the instrument.

An instrument by Magal (1991) for measuring information center success and an instrument by Seddon and Kiew (1994) for measuring information system success were adapted in this study to measure library success. Both instruments were based on an instrument by Ives, Olson, and Baroudi (1983) that was in turn based on a modified version of an instrument originally developed by Bailey and Pearson (1983) for measuring satisfaction with information systems.

Magal (1991) proposed a model of information center success based on 3 dimensions: quality of information center staff service, quality of user-developed applications, and user self-sufficiency. Substituting information quality for the quality of user-developed applications, the corresponding dimensions that appear applicable to success of libraries are: quality of library staff service, quality of information received, and user self-sufficiency. Because of the nature of information, it is difficult to separate the tangible product from the more intangible process of delivery (Goldhar, 1979). However, since information is the product, or outcome, in a library, similar to the way user-developed applications are the products in an information center, it could be considered separate from, and not a subset, of service. In a study of library reference service, Murfin and Gugelchuk (1987) found that library customers appear to distinguish between satisfaction with service provided and satisfaction with the information received. For the purposes of this study, then, service refers to the delivery process, and the variables associated with service are related to how service is delivered by the library staff.

Variables associated with information, on the other hand, refer to the outcome, or nature of the information product, such as the comprehensiveness or accuracy of the information received.

Magal (1991) made a number of modifications to the Ives, Olson, and Baroudi (1983) instrument to reflect aspects believed important to information center success. Magal also changed the scale from a semantic differential to a 7-point scale ranging from low to high, and asked respondents to indicate both importance and performance for each item. Magal's instrument seems appropriate for measuring library success, since libraries and information centers share similar tasks in regard to supporting end users. Only minor modifications were made to the wording of Magal's instrument to refer to a library rather than an information center.

The Seddon and Kiew (1994) instrument is based on a model of information system success developed by DeLone and McLean (1992). The major difference is that Seddon and Kiew added a factor related to user involvement to distinguish between the concepts of involvement and user participation, and they substituted usefulness for use. Seddon and Kiew's instrument differs from Magal's because it includes system quality rather than service quality and has no factor related to user self-sufficiency. Seddon and Kiew used a 7-point scale similar to the one used by Magal.

Since the scales used by both Magal (1991) and Seddon and Kiew (1994) are similar to the service quality scale used by Parasuraman, Zeithaml, and Berry (1994), the same scale was utilized in this study when the instruments were combined to form the library success instrument. This was done in order to compare each instrument in regard to

how well it predicts library satisfaction and library service quality. A procedure similar to that used by Kettinger and Lee (1994) was followed to examine how the instruments relate to one another, and to compare results to those obtained by Kettinger and Lee.

Although the original Bailey and Pearson (1983) instrument included a dimension based on participation and involvement, Seddon and Kiew (1994) recommended distinguishing between participation in the development process and involvement. Barki and Hartwick (1989) stated that involvement is more of a psychological state and refers to how important or personally relevant the system is to the user. Most library users are unlikely to participate in the operation or management of a library. Although library users may be able to make suggestions, these suggestions are usually limited to recommending book purchases or placing books on reserve. At times a user may engage a librarian in a database search, but this may not translate into the same feeling of participation an end-user experiences in the software development process. On the other hand, the importance or personal relevance of a library to library users should be similar to the importance of an information center to information center users. In order to distinguish between these concepts, 6 questions related to involvement were added to the library success instrument used in this study. These items were based on an instrument developed by Zaichowsky (1985) to measure user involvement.

Seddon and Kiew (1994) have conjectured that usefulness may be a better measure of system success than use. DeLone and McLean (1992) stated that use is only pertinent when use is voluntary, and in many cases usefulness is a more appropriate measure than use (Seddon and Kiew, 1994). The use of a library is usually voluntary; however, often

there is no other alternative available to the user, so the user may feel there is little choice but to use what is available, even if it is not completely satisfactory. For this reason, 6 questions pertaining to usefulness from an instrument developed by Davis (1989) were added to the library success instrument used in this study.

Although Magal (1991) did not include a dimension for system quality in an instrument for measuring information center success, Seddon and Kiew (1994) included system quality as a factor that influenced information system satisfaction. Most libraries maintain and operate an online version of the card catalog, which is central to locating items within the library's collection. The online card catalog is the main interface between library users and the library's computer system and may affect a library user's satisfaction. Questions pertaining to system quality are distinguished from questions on information quality in that system quality relates more to how easy the system is to use or how well the hardware itself functions rather than the quality of information within the system. Six questions pertaining to ease of system use from an instrument developed by Davis (1989) were added to the instrument used in this study.

The instrument used in this study, then, is based on a model of library success that includes the following 7 dimensions: service quality, system quality, information quality, user involvement, usefulness, user self-sufficiency, and user satisfaction. Although additional dimensions, such as individual impact, work group impact, and organizational impact, have been identified as influencing system success (Myers, Kappelman, and Prybutok, 1997), these lie outside the scope of the present study.

Statement of the Problem

Three problems related to library service quality were examined in this study. What form of SERVQUAL is best for measuring library service quality? Can instruments that measure information center success and information system success be used to measure library success, and how do these instruments relate to SERVQUAL? Finally, how does library service quality relate to library success?

In order to answer the first question, 5 problems associated with SERVQUAL were examined. These pertain to the use of difference scores versus performance scores, the difference between measuring importance and expectations, the difference between measuring the importance of SERVQUAL's dimensions and the importance of individual items, the difference between library service quality and library satisfaction, and the number of dimensions that compose SERVQUAL. In addition, the differences in library users and perceptions of library service quality were examined.

To answer the remaining questions, an instrument for measuring information center success and an instrument for measuring information system success were examined to see if they were applicable to libraries. SERVQUAL and a library success instrument were examined to see how they relate, and a model of library success was tested to see how library service quality relates to other variables that affect library success.

In order to compare SERVQUAL and a library success instrument, a procedure similar to that used by Kettinger and Lee (1994) was adopted. Kettinger and Lee wanted to know if SERVQUAL was significantly associated with the Ives, Olson, and Baroudi instrument and if some combination of SERVQUAL and the Ives, Olson, and Baroudi

instrument predicted overall user satisfaction better than the Ives, Olson, and Baroudi instrument alone. The same question was examined in this study, but a combination of the instruments also was examined to determine if together they predicted library service quality better than either instrument alone.

Research Approach

The purpose of this study was to test modifications to the 1994 version of SERVQUAL to determine the best format to use for measuring library service quality. The purpose of this study was also to examine whether an instrument developed by Magal (1991) to measure information center success and an instrument developed by Seddon and Kiew (1994) to measure information system success could be adapted to measure library success. The instruments were examined separately and in combination to see how well they predicted library service quality and library satisfaction. Eleven hypotheses were investigated in an attempt to find the most effective method of measuring library service quality with SERVQUAL and to answer the question of how service quality relates to library success. Specific problems that have been identified with SERVQUAL were examined in the first 5 hypotheses. Different variables that affect how library service quality is perceived, and whether library service quality affects subsequent library use and intentions were examined in hypotheses 6 and 7. How a measure of library success relates to SERVQUAL was examined in hypothesis 8. How a measure of library success compares to measures of information system and information center success was examined in hypothesis 9, and how library service quality relates to other variables that affect library success was examined in hypotheses 10 and 11.

Hypothesis 1: Performance scores exhibit higher reliability and validity, and explain more variation in library service quality than difference scores.

Hypothesis 2: Performance minus importance scores exhibit higher reliability and validity, and explain more variation in library service quality than performance minus expectation scores.

Hypothesis 3: The relative importance of service quality dimensions obtained by allocation of points to dimensions differs from those obtained by ratings of the importance of individual items.

Hypothesis 4: When expectations are described as what a library "can and should deliver", performance minus expectation scores predict library service quality better than library satisfaction, and performance minus importance scores also predict library service quality better than library satisfaction.

Hypothesis 5: When library service quality is calculated using performance or expectation scores, the number of dimensions SERVQUAL exhibits is different from when library service quality is calculated using difference scores, and library service quality exhibits either a 5 or 3-dimensional structure similar to that found by Parasuraman, Zeithaml, and Berry in 1994.

Hypothesis 6: Perceptions of library service quality differ by gender, occupation, and amount of reliance on library staff, but do not differ by age or frequency of library use.

Hypothesis 7: Library users who perceive the library as useful or who consider library service valuable rate library service quality higher, and library users who rate library service quality high are more likely to use the library in the future or to recommend the service to others.

Hypothesis 8: A library success instrument and SERVQUAL together predict user satisfaction with the library better than a library success instrument alone, and both instruments predict library service quality better than SERVQUAL alone.

Hypothesis 9: A library success instrument based on instruments for measuring information center and information system success exhibits similar reliability and validity to instruments used to measure information center and information system success.

Hypothesis 10: Increases in library service quality, information quality, system quality, user self-sufficiency, and involvement result in increases in perceived library usefulness, and increases in library service quality, information quality,

system quality, user self-sufficiency, involvement, and usefulness result in increases in library satisfaction.

Hypothesis 11: Quality of library service predicts library satisfaction as well as, or better than other variables related to library success.

Significance of the Study

Results from this study should assist library managers and researchers identify how to use SERVQUAL more effectively to measure service quality in libraries and how to measure library success more effectively from the library user's perspective. Results should also help library managers and planners determine how much service quality influences overall library success from the library user's viewpoint. Determining what form of SERVQUAL is better for measuring service quality in libraries offers the potential for developing a more effective instrument for measuring service quality within libraries. Results from this study also offer the potential for developing a new instrument to measure library success that encompasses the role service quality plays in the overall success of libraries from a user's perspective.

Although SERVQUAL has been used in libraries to measure service quality, none of the previous library studies attempted to modify the 1994 version of SERVQUAL in order to determine if problems that have been reported with the instrument can be minimized or avoided. If libraries are going to use SERVQUAL to measure service quality from the user's perspective, it is important to determine what form of SERVQUAL is best

for measuring service quality in libraries. At the same time, it is important to show how service quality contributes to the overall success of libraries, especially as libraries move toward more digital or electronic environments. By testing a model of library success that includes service quality, this study should help resolve the question of how much service quality contributes to library success.

Limitations

The scope of this study was limited by several factors. Although, responses were gathered from different library sites within the U.S. Army Corps of Engineers, results may not generalize to a larger population of library users. The libraries used in this study differ from public or academic libraries in the demographics of library users, in the scope of services available, and in the way library customers are charged for services. The libraries in this study are both special research libraries whose primary customers are government engineers and scientists. Customers in these libraries are charged indirectly for services through annual departmental accounts and directly for some online connect fees. This study was further limited by the use of a mail survey, especially in regard to low response rates that are typically associated with mail surveys.

Since this study was limited to an examination of SERVQUAL and to instruments based on the Bailey and Pearson instrument for measuring user satisfaction with information systems, it is subject to the problems associated with these instruments. Although these instruments are among the most widely used for measuring service quality and user satisfaction with information systems, they have both been subject to criticism

within the literature, and a number of problems have been identified with each of the instruments (Van Dyke, Prybutok, & Kappelman, 1997; Galletta & Lederer, 1989).

Definitions

Online Public Access Catalog:

An online public access catalog (opac) is defined as a computer-based catalog of a library's collection or holdings that is available to both internal and external library customers. The U.S. Army Waterways Experiment Station Research Library's GEAC system is considered representative of an opac.

Library End Users:

Library end users are defined as employees of the U.S. Army Corps of Engineers who are local or remote customers of Corps libraries or the Corps library program.

Library Service Quality:

Library service quality refers to the perceived quality of library service received by end users of a Corps library. Respondent scores on Section A, questions 1 through 28, and Section C, questions 1 through 6 and 8, of the survey instrument are considered indicators of library service quality.

Library User Satisfaction:

Library user satisfaction is defined as the net feeling of satisfaction or pleasure that results from the use of a library by a library user. Respondent scores on Section E, questions 2 through 5 and 7, of the survey instrument are considered indicators of library user satisfaction.

Library Use:

Library use is defined as the number of times an end user estimates using or requesting service from a Corps library. Respondent scores on Section F, question 1, of the survey instrument are considered indicators of library use.

Information Quality:

Information quality refers to the perceived quality of attributes of information obtained by end users of a library. Accuracy, relevancy, precision, reliability, completeness, and currency are considered attributes of information quality, and respondent scores on Section C, questions 9 through 14, of the survey instrument are considered indicators of information quality.

Library System Quality:

Library system quality refers to the perceived ease of use of the library online public access catalog or system by end users. Respondent scores on Section C, questions 19 through 22, of the survey instrument are considered indicators of library system quality.

Library Usefulness:

Library usefulness is defined as the degree to which a library user believes that using a Corps library would enhance his or her performance or productivity. Respondent scores on Section B, questions 1 through 6, of the survey instrument are considered indicators of library usefulness.

Library User Self-sufficiency:

Library user self-sufficiency refers to the degree to which a library end user is able to operate independently or feel in control when using the library. Respondent scores on

Section C, questions 7 and 15 through 18, and Section F, question 4, of the survey instrument are considered indicators of library user self-sufficiency.

Library User Involvement:

Library user involvement refers to how personally relevant or important the library is to the end user. This study considers respondent scores on Section E, question 8, of the survey instrument as indicators of library involvement.

Library Success:

Respondent ratings of library service quality, library system quality, information quality, library usefulness, library user self-sufficiency, and library user satisfaction are considered indicators of library success.

Outline of the Report

A brief background and introduction to the research problem, its significance, and scope was presented in this chapter. A review of the literature pertaining to the theory of service quality and information system success as it applies to libraries is presented in chapter 2. A description of the methodology that was used to conduct this research is presented in chapter 3. The survey results obtained are presented in chapter 4, and an analysis of the results is presented in chapter 5. The significance of the conclusions resulting from this research, implications for managers, and suggestions for future studies of library service quality and library success are presented in chapter 6.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

This chapter is divided into 4 sections. A review of the literature pertaining to service quality in general is presented in the first section. A review of the literature pertaining to the measurement of service quality, especially the SERVQUAL instrument, a review of the problems reported with SERVQUAL and proposed alternatives or modifications to SERVQUAL is presented in the second section. A review of the literature pertaining to the measurement of information center and information system success is presented in the third section. A review of the literature pertaining to library service quality and library success is presented in the fourth section.

Service Quality

Gummesson (1991) referred to service quality as an adolescent because research into service quality started only in the late 1970's. Gummesson stated that although research into goods or product quality has been extensive and covers at least 7 decades, service quality is different than goods quality, so it must be managed and measured differently. Parasuraman, Zeithaml, and Berry (1991) asserted that although efforts at defining and measuring quality have come largely from the goods sector, knowledge of goods quality is not sufficient to understand service quality because of 3 distinguishing characteristics that separate goods from services. One distinguishing characteristic is the intangible nature of services, which makes it difficult to establish precise manufacturing

specifications for quality. Another distinct characteristic of services is their heterogeneous nature. Service performance can differ from context to context and from person to person, making it difficult to insure uniform quality. A third characteristic of services is that often the production and consumption of services can not be separated as they can in goods production. Parasuraman, Zeithaml, and Berry concluded this makes service quality more dependent on the perceptions of the customer. In fact, there is considerable emphasis in the service quality literature on the importance of determining what the customer expects and perceives in regard to service quality. The unique characteristics of service quality make it more difficult for customer's to evaluate service than goods quality, according to Parasuraman, Zeithaml, and Berry, and such evaluations rely not only on outcome, but also on the process of delivery. Parasuraman, Zeithaml, and Berry have conjectured that the perception of service quality stems from a comparison of what a customer expects and what actual service is received.

The field of service quality research has evolved from two basic streams of thought, one representing the Nordic school and the other the North American school (Brogowicz, Delene, & Lyth, 1990). The Nordic school is rooted in the studies and writings of Christian Gronross, whereas the North American school reflects the writings of Parasuraman, Zeithaml, and Berry.

Gronroos (1982) defined service as physically intangible, as an activity rather than a thing, where production and consumption are done simultaneously. One of Gronross's major contributions was to delineate the difference between functional and technical quality. Technical quality, Gronroos (1984) said, pertains to what a customer receives,

whereas functional quality pertains to how a customer receives a service. Thus, for Gronroos, technical quality is dependent on external factors such as machines, and acquired skills or knowledge, and functional quality is more dependent on internally affected factors such as appearance, attitude, and behavior. While the two concepts are related, Brogowicz, Delene, and Lyth (1990) have pointed out that Gronross feels the more important of the two in regard to its impact on perceived service quality is functional quality. Functional quality is also more difficult for consumers to evaluate (Brogowicz, Delene, & Lyth, 1990). The other important facet of Gronross's model of service quality is that perceived service quality is highly dependent on the difference between expected service and perceived service. Within this school of thought, the way a customer perceives service quality is heavily influenced by the difference between what the customer expects to receive and what the customer actually receives.

The distinction between what a customer expects and what a customer receives led Parasuraman, Zeithaml, and Berry (1985, 1988) to posit a theory of service quality based on the gaps between what customers expect and the service customers perceive is provided. Parasuraman, Zeithaml, and Berry's model of service quality is built around 5 major gaps in service. The first gap is the difference between what consumers expect and what management believes consumer expect. The second gap is the difference between what management believes consumers expect and how these expectations are translated into specifications for delivery of service. The third gap is the difference between specifications of service and the actual delivery of service. The fourth gap is the difference between what service is delivered and what management communicates to consumers

about service. The fifth gap, and probably the most controversial, is the difference in what service consumers expect to receive and what they perceive they receive (Zeithamal, Parasuraman, & Berry, 1990).

The gap model of service quality is related to the confirmation/disconfirmation paradigm found in studies of customer satisfaction (Ennew, Reed, & Binks, 1993). When a customer compares the performance of a product to his or her expectations of the product, these expectations are either confirmed when the product meets expectations or disconfirmed when the product does not meet expectations. The customer's overall satisfaction with a product or service is then a function of the level of confirmation or disconfirmation (Ennew, Reed, & Binks). However, there are problems with the measurement of disconfirmation, whether measured as a difference score or as a summary judgement (Prakash & Lounsbury, 1983). The use of difference scores to measure disconfirmation suffers from low reliability, while an overall judgemental approach does not indicate which expectations were confirmed or disconfirmed, according to Prakash & Lounsbury. Similar reliability problems may occur when difference scores are used to measure service quality.

Measures of Service Quality

Based on their model of service quality, Parasuraman, Zeithaml, and Berry (1988) developed an instrument for measuring service quality called SERVQUAL from focus interviews and prior qualitative research into the dimensions along which consumers perceive and evaluate service quality. Originally, this instrument was based on 10 dimensions of service: tangibles, reliability, responsiveness, communication, credibility,

security, competence, courtesy, understanding/knowing the customer, and access. These were later reduced through factor analysis to 5 dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Tangibles refer to physical facilities, equipment, and personnel. Reliability refers to the ability of a firm to perform promised service dependably and accurately. Responsiveness is the willingness to help customers and provide prompt service. Assurance is the ability of employees to inspire trust and confidence in customers. Empathy refers to the amount of caring and individualized attention provided to customers.

The 1988 version of SERVQUAL consisted of 22 questions regarding expectations of service and 22 identical questions regarding performance of service. Responses were made on a 7-point scale that ranged from strongly agree to strongly disagree, with no verbal labels for the intermediate scale points. However, Parasuraman, Zeithaml, and Berry changed the format of SERVQUAL in 1994 to consist of 21 questions, and responses were made on a 9-point scale that ranged from low to high. Expectations were divided into two sections, one to reflect the minimal level of service quality the customer would accept or tolerate, and the other the level of service quality the customer desired. Rather than repeat the same set of questions for both expectations and performance, responses were made in 3 boxes for each item. The first box indicated the minimal service level, the second the desired service level, and the third the perceived performance.

Three other changes were made to SERVQUAL in 1994. First, the item pertaining to the maintenance of error free records was deleted. Next, the item pertaining to keeping

customers informed about when services will be performed was reassigned from the responsiveness dimension to the reliability dimension. Finally, the item pertaining to convenient hours of operation was reassigned from the empathy dimension to the tangibles dimension.

Service quality scores for SERVQUAL are calculated by subtracting the ratings of expected level of service from the ratings of perceived levels of service received. The score can be averaged across each dimension to serve as a measure of that particular facet or averaged across all items as an overall measure of service quality. The instrument is designed to be applicable across a broad spectrum of services and be capable of modification to accommodate different circumstances (Parasuraman, Zeithaml, & Berry, 1988).

SERVQUAL is built around the concept of perceived quality. Perceived quality is not the same as objective quality and consists of the consumer's judgement about an entity's overall excellence (Zeithaml, 1988). It is a form of attitude that is related to, but not the same as, satisfaction (Parasuraman, Zeithaml, and Berry, 1988). The distinction between service quality and satisfaction is an important one, and one that has sparked considerable debate among service quality researchers. Parasuraman, Zeithaml, and Berry have conjectured that service quality is a global judgement or attitude that relates to superiority of service, whereas satisfaction is related to a specific transaction. Theoretically, then, it is possible to have satisfied customers and poor service quality, or unsatisfied customers and good service quality. Indeed, Parasuraman, Zeithaml, and Berry (1988) have cited instances when respondents in focus group interviews indicated they

were satisfied with a specific transaction but did not feel the firm had high quality service. Incidents of satisfaction over time result in perceptions of service quality, according to Parasuraman, Zeithaml, and Berry. This has led some researchers to suggest that satisfaction is an antecedent of service quality (Bitner, 1990; Bitner & Hubbert, 1994; Bolton & Drew, 1991). However, some researchers have asserted there is general confusion in the service quality literature regarding the relationship between customer satisfaction and service quality (Clow, 1992; Cronin & Taylor, 1992; Dabholkar, 1993). The distinction between satisfaction and service quality is not conclusive, according to Liljander (1994). Patterson and Johnson (1993) stated that the two constructs have not been well defined and some writers use the terms interchangeably. The confusion, according to Cronin and Taylor, revolves around the definition of service quality as a form of attitude. Cronin and Taylor pointed out that there is a hesitancy to call perceived service quality an attitude, because if it is an attitude, then SERVQUAL may not be the best method of measuring it. Although SERVQUAL is dependent on the use of a disconfirmation framework as the primary measure of service quality, Cronin and Taylor have conjectured that disconfirmation may only mediate instead of determine a consumer's perception of service quality. Ford (1990) has also questioned the difference between satisfaction and service quality and asked how many transactions does it take to form a global attitude. It is not entirely clear whether SERVQUAL is measuring quality rather than satisfaction, according to Ford. Indeed, a study by Van Dyke, Prybutok, and Kappelman (forthcoming Summer 1999) found that SERVQUAL was a better predictor of overall satisfaction than of overall service quality. Van Dyke, Prybutok, and Kappelman

have suggested these results imply a possible construct validity problem with SERVQUAL. Construct validity is concerned with what construct underlies the score achieved on a test and is the most difficult type of validity to establish (Churchill & Nielsen, 1990). When an attribute is not operationally defined, as the case with service quality, construct validation becomes necessary (Cronbach & Meehl, 1955).

Researchers also disagree whether service quality should be calculated as the difference between perceived and expected service. Parasuraman, Zeithaml, and Berry (1988) stated that since, in the mind of the consumer, service quality depends on how expectations compare to perceptions of performance, service quality should be calculated by subtracting ratings of expected levels of service from ratings of perceived levels of service received. The average score of all items represents the overall measure of service quality (Brown, Churchill, & Peter, 1992). However, two problems arise in respect to calculating service quality in this manner. One is related to confusion over what is actually being measured by expectations, and the other is related to the general problematic nature of difference scores.

Teas (1993) questioned the validity of the perceptions minus expectations model of service quality because of a number of problems with the conceptual and operational definition of the concept of expectations. Parasuraman, Zeithaml, and Berry (1988, 1993) have defined expectations as what a consumer believes a service should offer rather than what it would offer, or as a normative standard. These expectations were considered desires or wants of the consumer, not predictions of service the consumer thinks would be received. However, there is confusion among researchers regarding whether service

quality expectations represent predictions or ideal standards. Boulding et al. (1993) has pointed out that expectations based on predicting what is most likely to happen are not the same as the "ideal" or desired standard frequently used in service quality research. Ideal expectations may be unrelated to what a customer believes is feasible for the service provider to deliver.

Teas (1993) found different interpretations of expectations by consumers, based on follow-up interviews to a SERVQUAL survey. One interpretation is that expectations are predictions of service, or what consumers believe they will receive. This interpretation is similar to expectations as described in the customer satisfaction literature, and fails to adequately distinguish between the concepts of service quality and customer satisfaction. A second interpretation of expectations is that they are a measure of attribute importance. Parasuraman, Zeithaml, and Berry (1994) pointed out that they have never suggested using survey questions to measure the importance of individual items. Instead Parasuraman, Zeithaml, and Berry have favored measuring the importance of the dimensions the items are supposed to represent. Nonetheless, Smith (1995) noted that some researchers have directly substituted importance measures for expectations while failing to use consistent scales (Webster, 1989; Lewis 1991; Bouman & Van der Wiele, 1992). Rating level of importance on a 7-point scale ranging from unessential to essential is not the same as rating expectations of excellence on a 7-point scale ranging from strongly agree to strongly disagree, according to Smith. It is also important to note that Parasuraman, Zeithaml, and Berry changed both performance and expectation scale end points in 1994 to range from low to high, resulting in a more consistent scale. Cronin and

Taylor (1994) have suggested that it may be useful to plot the importance of items relative to perceptions of service performance for each item. Indeed, Smith (1995) recommended that importance be substituted for expectations since "providing what is important to the consumer would appear to be more meaningful, than expectations of excellence, to a practitioner who is targeting in terms of value" (p. 394).

Teas (1994) described a third type of expectation as a classic ideal point, where the consumer's ideal level of service represents a finite level, and performance beyond this level will result in decreases in performance ratings. For example, if a store clerk is dressed too neatly for some customers, the store's service may be rated lower. The varying definitions of expectations results in a loosely defined construct that is open to multiple interpretations, according to Teas, and this is in turn results in a large degree of measurement error in the SERVQUAL instrument. Teas stated that a considerable amount of the variance in SERVQUAL is the result of varying interpretations of the expectation section of the survey.

Parasuraman, Zeithaml, and Berry attempted to resolve this conflict by adopting a multi-level approach to expectations, which they describe as a zone of tolerance (Parasuraman, Zeithaml, & Berry, 1994). This involves taking 2 expectation measures, one that reflects what consumers desire and one that reflects what consumers consider is minimally acceptable. Theoretically, then, according to Parasuraman, Zeithaml, and Berry (1994), a consumer's desired level of service relates to their ideal level of service, while the minimally acceptable level of service relates to their predicted level of service. Parasuraman, Zeithaml, and Berry have conjectured that this model reconciles the

differences between service quality and consumer satisfaction. However, Parasuraman, Zeithaml, and Berry have not provided any evidence that measuring minimally acceptable levels of service is the same as measuring predicted levels of service, nor that separating expectations into zones of tolerance enables SERVQUAL to better distinguish between service quality and customer satisfaction. Indeed, introducing an additional measure of expectations may only further confound the two constructs. Furthermore, adding an additional measure of expectations does not eliminate any reliability problem that might be caused by the use of difference scores.

Separating expectations into different levels also fails to distinguish between attribute importance and ideal expectations. Smith (1995) examined how substituting importance for expectations affected SERVQUAL and found that importance scales had a lower mean and higher standard deviation than measures of what would be expected from an excellent organization. Because of the lower mean scores for the importance scale, Smith stated that performance minus importance scores actually fit the postulated relationship between gap scores proposed by Parasuraman, Zeithaml, and Berry better than performance minus expectation scores.

Besides the confusion over what is being measured by expectations, some researchers contend that the use of any type of difference score poses reliability problems. Difference scores involve subtracting scores of one measurement from another measurement to create a new variable for use in subsequent data analysis, (Brown, Churchill, & Peter, 1992). One of the problems with difference scores is the ambiguity surrounding the term, according to Brown, Churchill, and Peter. Various types of scores

have been labeled difference scores even when they are not calculated in the same manner, and it is important to distinguish between them. Brown, Churchill, and Peter classified difference scores into 4 major types. The first type, change scores, the same score is taken from the same respondent at two points in time. The second type, deficiency scores, involves two different measures taken from the same respondent at different times. The third type, discrepancy scores, involves subtracting one subject's scores from another subject's scores on the same measure, and the fourth type, confounded scores, involves subtracting one subject's scores from another subject's scores on different measures. Brown, Churchill, and Peter also defined a fifth type of difference score called an external standard score. These scores consist of taking a single measure and subtracting an external norm or standard from it.

Brown, Churchill, and Peter (1992) pointed out that service quality, as measured by SERVQUAL, is an example of a deficiency score. This is because service quality is measured as the difference between a customer's expectations of what service should be provided and the same customer's perceptions of what service is actually provided. Thus, service quality, as measured by SERVQUAL, is an assessment of the degree to which a service is deficient in measuring up to what customers expect.

Difference scores all share 3 general types of problems, regardless of the type, according to Brown, Churchill, and Peter (1992). These include: theoretical, measurement, and computational problems. Difference scores suffer from theoretical problems because there is a lack of empirical evidence that people actually reason by subtracting one item from another when making choices or decisions. Johns (1981) has

pointed out that despite the persistent use of difference scores in organizational behavior research, difference scores exhibit a number of technical and conceptual properties which severely threaten their usefulness. Measurement problems associated with difference scores include potential unreliability, systematic correlation with their components, and spurious correlation with other variables, according to Johns.

Since the reliability of difference scores depends on the intercorrelation of the component scores as well as on the reliabilities of the component score, there is a danger that as the intercorrelation of the component scores increases, the reliability of the difference score decreases (Peter, Churchill, & Brown, 1991). Deficiency scores may be correlated since responses come from the same individual while using the same method, and the only difference in component scores is the perspective from which the respondents are tasked to consider, such as what is versus what should be (Peter, Churchill, & Brown). The tendency for difference scores to be highly correlated with one or more of the components used to form them can also lead to discriminant validity problems, according to Peter, Churchill, and Brown. Difference scores also often exhibit ceiling effects where one component score is consistently higher than the other, and this forces the range of the difference score variable to be constrained (Peter, Churchill, & Brown).

Computational problems involve confusion over how difference scores are interpreted and variations in meaning, according to Peter, Churchill, and Brown (1991). Varying interpretations of difference scores can arise in the manner in which difference scores are computed, especially when items are reverse-scaled to avoid response bias. Variation in meaning can also occur when the same difference score between responses

may mean something entirely different. For example, it is possible for customers to have the same difference scores yet very different levels of expectations and perceptions of service.

Brown, Churchill, and Peter (1992) pointed out 3 specific problems relevant to the way SERVQUAL uses difference scores to measure service quality. These include problems with reliability, discriminant validity, and variance restriction. Any positive correlation between the component scores decreases the reliability of the resulting difference score, and since difference scores in SERVQUAL are taken from the same respondent and subtracted to form a measure of a third construct, only rarely will the difference score components not be positively correlated. This means reliability will at least to some degree be attenuated, according to Brown, Churchill, & Peter.

Reliability refers to the accuracy or precision of a measuring instrument (Kerlinger, 1986). Campbell and Fiske (1959) distinguished reliability from validity by pointing out that whereas validity may be considered the agreement between two attempts to measure the same trait through different methods, reliability is the agreement between two attempts to measure the same trait through similar methods. A reliability coefficient is used to demonstrate whether a test designer is correct in expecting a certain collection of items to yield interpretable statements about individual differences (Cronbach, 1951).

Spreng (1994) differed with Johns (1981) and Peter, Churchill, and Brown (1991) regarding the reliability of difference scores, and stated that there are situations in which the use of difference scores may be valuable. According to Spreng, the low reliabilities of difference scores reported by some researchers, such as Prakash and Lounsbury (1983),

may be due to problems in their analysis and that the reliability of difference scores may not be as low as claimed.

Besides reliability problems, Peter, Churchill, and Brown (1991) pointed out that difference scores also suffer from the lack of discriminant validity. Although in theory the difference score is supposed to represent a construct that is distinct from the constructs of its component measures, in practice the difference is nearly always highly correlated with, and thus not distinct from, at least one of the component measures. Thus, any correlation that is evidenced between a difference score and another variable may be an artifact of the relationship between the component measures used to form the difference score and the other variable (Peter, Churchill, & Brown, 1991).

In addition, a problem of variance restriction occurs when one of the component scores used to calculate a difference score is consistently scored higher than the other component. According to Peter, Churchill, and Brown (1991), the expected level of service is almost always rated higher in SERVQUAL than the perceived level of service. Because respondents who perceive service to be good have a more constrained potential range on the SERVQUAL score, the result is smaller variance in SERVQUAL scores for respondents who rate service highly than for those less satisfied with service, (Peter, Churchill, & Brown, 1991).

In order to avoid some of the problems reported with difference scores, several service quality researchers have made modifications to SERVQUAL. Some of these changes reflect conceptual differences in the way in which service quality is perceived, while others attempt only to change the manner in which service quality scores are

calculated. These attempts seem to echo advice by Cronbach and Furby (1970) that investigators asking questions regarding gain scores "would ordinarily be better advised to frame their questions in other ways" (p. 80).

Carman (1990), Babakus and Boller (1992), and Peter, Churchill, and Brown (1991) have advocated combining both expectations and perceptions into a single question. Rather than using "strongly disagree" and "strongly agree" as the anchors at the end of the perception questions, they suggested replacing them with "much worse than I expected" and "much better than I expected" in order to retain expectations. DeSarbo, Huff, Rolandelli, and Choi (1994) took a similar tact in a conjoint analysis study and had respondents rank profiles of bank services by differing levels of expectations.

Cronin and Taylor (1992), and Teas (1993), on the other hand, recommended that expectation ratings be eliminated altogether. According to Liljander (1994), there is more support for performance only models than the disconfirmation model of service quality. This approach reflects a more radically different concept of how service quality is perceived. Only the performance questions are utilized. Bolton and Drew (1991) stated that assessments of overall service quality are affected only by perceptions of performance levels. They suggested that direct measures of disconfirmation are more important than expectations. Boulding et al. (1993) also suggested that perceptions alone influence overall service quality. Such approaches question the gap model of service quality as described by Parasuraman, Zeithaml and Berry (1988).

Cronin and Taylor (1992) called their instrument SERVPERF, since it is founded on the use of performance perceptions alone to assess service quality. When Cronin and

Taylor (1992) compared SERVPERF to SERVQUAL, their results indicated that performance scores alone accounted for more variation in service quality than performance minus expectations. Cronin and Taylor's model of service quality is sometimes referred to as an attribute-based theory of service quality to distinguish it from the gap-based model of Parasuraman, Zeithaml, and Berry. According to Cronin and Taylor, their model is more suited to measuring service quality as an attitude than Parasuraman, Zeithaml, and Berry's model because it is based on an adequacy-importance form of attitude model which is more efficient at predicting behavioral intention or actual behavior. Teas (1993) found higher validity in a version of SERVQUAL based only on performance scores rather than one that utilized difference scores, and Maples (1997) found that SERVPERF outperformed SERVQUAL in a study of information system quality. Even Parasuraman, Zeithaml, and Berry (1994) found that performance scores alone account for more variation in overall service quality than scores based on performance minus expectations. Kettinger and Lee (1997) listed the advantages of SERVPERF over SERVQUAL as more predictive power, more efficient data collection, higher reliability, and more construct validity.

The only two areas where SERVQUAL appears superior to SERVPERF, according to Kettinger and Lee (1997), are in diagnostic value and data richness. This echoes Parasuraman, Zeithaml, and Berry's (1994) defense of measuring expectations in order to provide additional information to management. However, Smith (1995) has contested whether SERVQUAL has more practical or diagnostic value than SERVPERF. Smith stated that measuring importance of attributes may be of more practical value to

management than measuring expectations, and that determining what service is important to customers may be more meaningful for managers than determining what service consumers expect. This implies that data pertaining to importance may be at least as rich as data pertaining to expectations. Ennew, Reed, and Banks (1992) suggested that importance ratings can provide important diagnostic information for managers when presented in a matrix such as constructed by Martilla and James (1977). Cronin and Taylor (1994) took a similar approach and recommended the use of performance-importance maps developed by Hawes and Rao (1985). If there is no statistical advantage to using difference scores, then the question remains whether it is important to managers to measure expectations, and how that differs from measuring importance.

Some researchers avoid the problems of difference scores by using alternate computational methods. Wall and Payne (1973), stated it is possible to calculate deficiency scores using only the raw scores through part or partial correlation and advocated the use of raw scores alone in such situations. Edwards (1994) demonstrated the utility of multivariate regression as an alternative to difference scores as dependent variables in the study of congruence. There appear, then, to be primarily two approaches to avoiding the use of difference scores with SERVQUAL. One approach is to avoid expectation scores altogether and discount their importance when measuring service quality, the second is to retain expectations by either re-framing the questions so that expectations are combined with perceptions, or use an alternate computational method to infer expectations.

Besides the problem of using difference scores, researchers report varying numbers of dimensions in regard to SERVQUAL and question whether it is generic across several

types of industries. Parasuraman, Zeithaml, and Berry (1988) proposed that SERVQUAL consisted of 5 dimensions, and that it could be used in various types of organizations to measure service quality. Babakus and Boller (1992) found evidence of only 2 dimensions. Carman (1990) found evidence that the dimensions of SERVQUAL may not be generic across different service industries and recommended retaining 7 or 8 of the 10 dimensions that Parasuraman, Zeithaml, and Berry examined in their original study. Cronin and Taylor (1992) have suggested that SERVQUAL may be unidimensional, since their study resulted in nearly all the SERVQUAL items loading on a single factor. Parasuraman, Zeithaml, and Berry found evidence for both a 5-dimensional structure and a 3-dimensional structure in 1994. What is causing these different dimensional patterns is not clear, but there appears to be no consensus regarding the number of dimensions.

Measures of Information System and Information Center Success

After an extensive review of the literature, DeLone and McLean (1992) divided measures of information system success into 6 major categories: (1) system quality, (2) information quality, (3) use, (4) user satisfaction, (5) individual impact, and (6) organizational impact. DeLone and McLean proposed a model of information system success built around these 6 dimensions. In their model, system quality and information quality both influence use and user satisfaction, which in turn influence the impact of the system on the individual user and the organization. Figure 1 is the information system success model developed by DeLone and McLean.

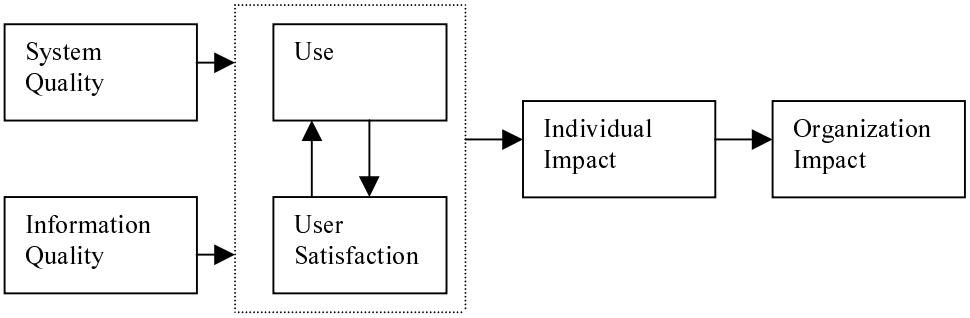

Figure 1. DeLone and McLean's Model of Information System Success. (Copyright 1992 by The Institute of Management Sciences, currently INFORMS, 901 Elkridge Landing Road, Suite 400, Linthicum, MD 21090 U.S.A. Used by permission.)

DeLone and McLean pointed out that user satisfaction is the most widely used measure of information system success. DeLone and McLean attributed this to the high degree of face validity of user satisfaction, the reliability of the instruments that have been developed for measuring user satisfaction, and the weakness of other types of measures of information system success. According to Galletta and Lederer (1989), user satisfaction is a popular measure because it is easier to obtain than less direct measures. Raymond (1987) stated that prior information system success research indicated an approach based on user satisfaction was preferable to an approach based on objective measures of use and performance.

Bailey and Pearson (1983) defined computer user satisfaction as "the sum of one's feelings or attitudes toward a variety of factors affecting that situation" (p. 531). Bailey and Pearson's model of computer user satisfaction was based on the sum of a user's weighted reactions to a set of factors. Bailey and Pearson developed an instrument to measure computer user satisfaction that consisted of 39 items, each one followed by four

7-point semantic differential scales. These scales consisted of bipolar adjectives that were used to describe each item.

Ives, Olson, and Baroudi (1983) reduced the number of items in Bailey and Pearson's instrument to 13 through factor analysis. The 3 major dimensions identified in Ives, Olson, and Baroudi's research were: (1) quality of information system output, (2) quality and service of the information system function, and (3) involvement in the development of the information system, according to Galetta and Lederer (1989). Ives, Olson, and Baroudi have stated that although ideally one might desire to evaluate an information system based on its productivity benefits or positive impact on decision making, this approach is generally not feasible. However, Ives, Olson, and Baroudi asserted that user satisfaction with information systems is measurable and an acceptable surrogate for utility in decision-making. Baroudi and Orlikowski (1988) reported good validity and reliability with the shortened version of the Bailey and Pearson instrument, although they pointed out that researchers interested only in an indication of global user satisfaction may find a single overall satisfaction rating more appropriate than a multi-item questionnaire.

A number of researchers have been critical of the Bailey and Pearson instrument as modified by Ives, Olson, and Baroudi (Goodhue, 1986; Galletta and Lederer, 1989; and Melone, 1990). Goodhue questioned the instrument on a theoretical basis. Galletta and Lederer found reliability problems in a test-retest study of the instrument. Melone questioned how well the instrument serves as a surrogate for information system effectiveness. Galletta and Lederer pointed to potential problems with differences in scale

units used in the instrument and recommended the use of a standard case measure for comparison purposes. According to Scarpello and Campbell (1983) and Ginzberg (1979), a single summary measure is more valid than multiple-item measures of user satisfaction.

Shirani, Aiken, and Reithel (1994) listed a number of reliability and generalization problems associated with user information satisfaction instruments. These problems, Shirani, Aiken, and Reithel claimed, stem from a lack of theoretical basis, the use of semantic-differential, Likert-type scales, lack of including user expectations, and a bias towards the use of existing systems rather than planned systems. Shirani, Aiken, and Reithel proposed a model of user information satisfaction that, like Parasuraman, Zeithaml, and Berry's model of service quality, is based on disconfirmation theory and is a function of the gap between user expectations and actual performance of the system. Iivari (1987) took a similar stance, and based user information satisfaction on the congruence of a user's belief between what information a user requires of the system and the capabilities of the system.

Part of the problem with measuring user satisfaction with information systems is that satisfaction with different aspects of an information system may vary. For example, user satisfaction may measure satisfaction with the system itself or with the information from the system. Kim (1989) categorized user satisfaction measures into 3 main categories: those measuring attitudes toward management information systems, those measuring satisfaction with information quality, and those measuring satisfaction with departmental performance. Bailey and Pearson's instrument was designed to measure satisfaction with the data processing staff performance, the information product, and the

amount of user involvement in training and development of the system (1983). Satisfaction with information quality has more impact on user performance than satisfaction with management information system effectiveness, and thus is a more appropriate surrogate measure for system effectiveness, according to Gatian (1994).

Some researchers have suggested greater emphasis on measuring service quality when determining system success. Rands (1992) argued that information technology may be considered as much a service as a product and that it must be managed similar to other services. Rands stated that considering information technology from a service perspective can provide a surrogate measure of information technology effectivenes. Rands further suggested that the service components of information technology be measured using the 5 dimensions of SERVQUAL. Watson, Pitt, Cunningham, and Nel (1993) asserted that service quality is actually a more appropriate measure of the effectiveness of information systems than user satisfaction because this is what information system departments really want to measure. According to Pitt, Watson, and Kavan (1995), service quality is a critical element in information system success due to changes in how information technology is used in organizations and greater emphasis on end-user computing. The primary reason information system departments measure user satisfaction is to improve service quality, and the perceived quality of service provided by the information system department is a key indicator of information system success (Pitt, Watson & Kavan, 1995). Pitt, Watson and Kavan proposed a model of information system success similar to the DeLone and McLean model, except service quality was included as one of the dimensions that affects

both use and user satisfaction. Figure 2 shows how the Pitt, Watson, and Kavan model differs from the DeLone and McLean model.

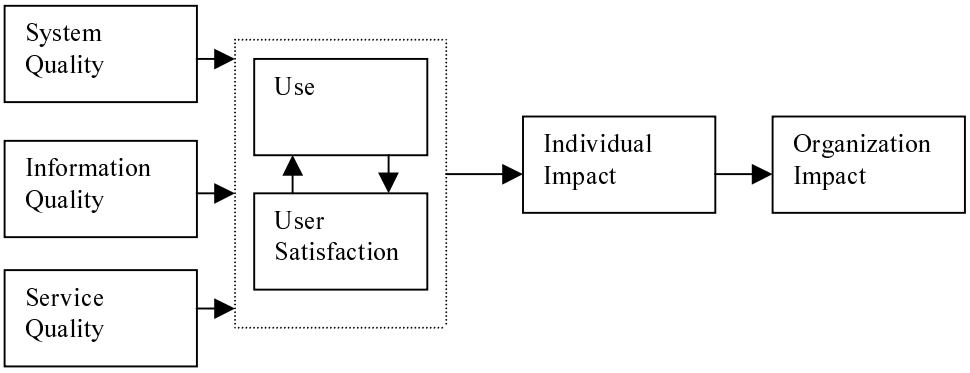

Figure 2. Pitt, Watson, and Kavan's Model of Information System Success. (Copyright 1995 by Pitt, Watson, & Kavan. Used by permission.)

Kettinger and Lee (1994) acknowledged the importance of the service dimension to information systems. Kettinger and Lee asserted that the trend toward external information system providers will result in a more competitive climate for information system providers, and will correspondingly mean a greater emphasis on providing quality services. Kettinger and Lee combined Bailey and Pearson's modified user information satisfaction instrument with Parasuraman, Zeithaml, and Berry's SERVQUAL instrument. Results indicated that SERVQUAL captured important aspects of information system service that the user information satisfaction instrument failed to measure. Kettinger and Lee did not examine whether the combined instruments also capture aspects of service quality that SERVQUAL alone does not measure. However, the results obtained by Kettinger and Lee indicated that in order to find an effective measure of information

system success, there was a need to examine whether existing system satisfaction measures should be supplemented with instruments measuring service quality.

Some researchers have recommended changing or adding dimensions besides service quality to the DeLone and McLean model. Myers, Kappelman, and Prybutok (1997) added the dimension of work group impact to the DeLone and McLean model, citing the importance of work teams in the current organizational environment and the impact of information systems on work group performance. Seddon and Kiew (1994) added the dimension of user involvement to the model and substituted usefulness for use. Seddon and Kiew conjectured that although use has been utilized as an objective measure of system success, use is only pertinent when use is voluntary, and in many cases usefulness is a more appropriate measure than use. Seddon and Kiew also stated that user participation in the development process of an information system is not the same as involvement with the system and should be measured separately. Figure 3 shows the modifications Seddon and Kiew recommended to the DeLone and McLean model.

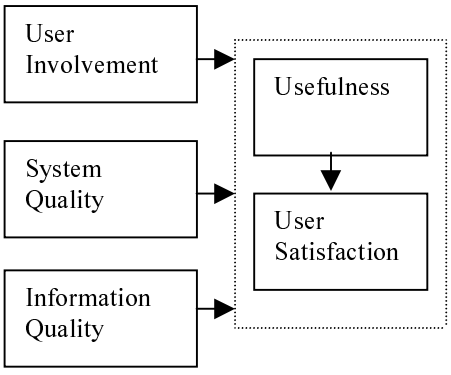

Figure 3. Seddon and Kiew's Model of Information System Success.
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Magal (1991) adopted the Ives, Olson, and Baroudi (1983) instrument for measuring information system success and applied it to information centers. Magal retained 11 of the 13 items used on the Ives, Olson, and Baroudi instrument. Magal added 2 items pertaining to quality of service and 2 items pertaining to user self-sufficiency and switched the item pertaining to relevancy of information product to pertain to relevancy of service provided. Three of the 4 items Magal added correspond to items on the original Bailey and Pearson instrument; thus, only the item pertaining to user independence was not on the original Bailey and Pearson instrument. Magal also changed the scale from a semantic differential to a 7-point scale ranging from low to high, and asked respondents to indicate both importance and performance for each item.

Magal's model of information center success is similar to Pitt, Watson, and Kavan's model of information system success. Figure 4 shows Magal's Model of Information Center Success. It is based on 3 dimensions: quality of information center staff service, user self-sufficiency, and quality of user-developed applications.

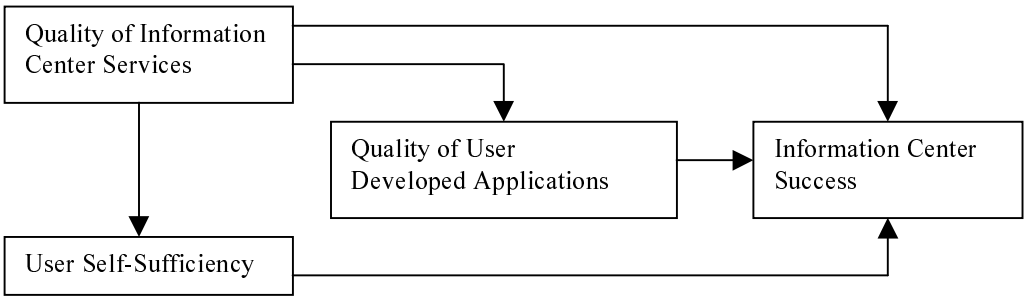

Figure 4. Magal's Model of Information Center Success.
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Probably the major difference in Magal's model of information center success and models of information system success is its emphasis on user self-sufficiency. Since Brancheau and Wetherbe (1985) identified the principal function of an information center as providing support for end-user computing, user self-sufficiency is considered an important dimension of information center success.

Measures of Library Service Quality and Library Success

Nitecki (1995) stated that the two concepts that underlie most attempts by libraries to evaluate service quality are effectiveness and disconfirmation. However, library effectiveness often is measured in terms of output performance, such as number of reference questions answered (Lancaster, 1988; Whitlach, 1990; Van House & Childers, 1993). Service quality may contribute to the effectiveness of a library, but effectiveness is often confused with efficiency and is usually measured from the viewpoint of the librarian rather than the user (McDonald & Micikas, 1994). How user perceived service quality relates to user satisfaction and library success does not appear to be clearly understood.

Nitecki (1995) has acknowledged that the concept of service quality has not been well defined in the library literature and that "theoretical overlaps appear between effectiveness, efficiency, and quality with operational definitions including measurements, for example of inputs, outputs, costs, benefits, and attainment of goals and standards" (p. 31). However, there is a need for a more user-centered approach to evaluating information service (Bawden, 1990), and it has only been recently, according to Nitecki, that library

researchers have begun to recognize that the best judge of library service quality is the library customer.

Until recently, most attempts to measure service quality in libraries have consisted of how accurately librarians respond to information requests or of how satisfied library customers are with specific service transactions. A number of previous studies have used unobstrusive methods to examine the success rate of reference librarians in responding to requests for specific information (Myers & Jirjees, 1983; Hernon & McClure, 1986; Benham & Powell, 1987). Childers (1991) has estimated that at least 40 studies have been done using this method, which consists primarily of someone posing as a real client and asking a library staff member a query, and judging the response primarily on correctness or completeness of the answer. However, these studies often rely on experts to judge the response success rather than the customer. Murfin and Gugelchuk (1987) estimated that more than 75% of these studies used either outside experts or other librarians to judge response success. When Murfin and Gugelchuk used customers to evaluate librarian responses, they found that customers could be satisfied either by the service provided or the quality of information received, and that it is necessary to measure both. Bicknell (1994) pointed out that accuracy of the answers users receive in a library may be of concern, but it may not be the sole indicator of quality service. Jardine (1995) echoed this concern, pointing out that there needs to be more emphasis on service as a whole, not just how accurately questions are answered by the library staff.

Bitner (1990) and Hernon and Altman (1996) have stressed the need for libraries to evaluate library service quality from the customer's perspective. The idea that library

customers lack the knowledge to evaluate library service is widespread in the library profession, according to Hernon and Altman, and this somehow justifies excluding customers from the process of evaluating library service quality. Hernon and Altman pointed out that libraries have traditionally evaluated quality in terms of efficiency or effectiveness, but have neglected the perspective of the customer. This attitude is dangerous because new technology, especially the Internet, has made it possible for people to seek other sources of information besides the local library.

Two primary approaches have been taken to measure library service quality from the user's perspective. One approach is to utilize SERVQUAL to measure service quality within libraries. Hebert (1994), Nitecki (1995), White and Abels (1995), Coleman, Xiao, Bair, and Chollett (1997), Srisa-Ard (1997), Maddox-Swan (1998), and Van Rooijen (1998) have used this approach. Hernon and Altman (1996) took a different approach and developed a different instrument for measuring library service quality based on case study research. Essentially, Hernon and Altman based their evaluation of library service quality on 3 dimensions: quality of the information product, quality of the service environment, and quality of service delivery, or staff behavior in the delivery process. Quality of the service environment compares to the tangibles dimension found in SERVQUAL and quality of service delivery compares to the responsiveness and empathy dimensions of SERVQUAL. There is no product dimension reflected in SERVQUAL since Parasuraman, Zeithaml, and Berry (1988) considered service quality to be different from product quality.

When Nitecki (1955) reviewed the library research that examined quality of reference service from the user's viewpoint, she found that most of the factors identified in these studies can be classified according to one of the 5 dimensions that Parasuraman, Zeithaml, and Berry claim make up SERVQUAL. Only 3 factors appeared to be outside SERVQUAL's framework, according to Nitecki, and these were related to the quality of the library collection (Childers & Van House, 1989; Lancaster, 1977; Hernon & McClure, 1990); characteristics of the users or purpose of use (Balay & Andrew, 1975; Hernon & McClure, 1990); and the organizational climate and management style of the library (Hernon & McClure, 1990). The two main instruments that have been used to evaluate reference service from the user's perspective, according to Nitecki, are the Reference Transaction Assessment Instrument (RTAI) developed by Murfin and Guglechuk, (1987), and the Reference Satisfaction Survey, developed by Van House, Weil, and McClure (1990). Although the RTAI instrument separated satisfaction with outcome and satisfaction with service delivery, both instruments were more concerned with measuring satisfaction with specific service encounters than the overall quality of perceived library service, and neither instrument attempted to measure customer expectations of service. Dalton (1992) and Edwards and Browne (1995) measured expectations of library service, but Dalton was concerned with user satisfaction rather than service quality, and Edwards & Browne were primarily concerned with the difference in service expectations between users and librarians.

Coleman, Xiao, Bair , and Cholett (1997) called for an evaluation of library service quality based on customer perceptions, and recommended the use of SERVQUAL to

measure library service quality. Coleman, Xiao, Bair, and Cholett found that it was difficult for library customers to differentiate library operations into individual units, but instead perceive the library as one entire enterprise. This implies that it may be better to measure the quality of library service as a whole, rather than trying to measure the individual components that make up that service. Indeed, information center customers are often asked to gauge the quality of service from the information center in its entirety, even though different personnel may be assigned to deal with hardware or network problems and software application problems.

Hebert (1993) used SERVQUAL to measure quality of interlibrary loan services in public libraries in Canada. Hebert used an unobstrusive method to investigate reference service by asking 130 participants to go to their public library and ask staff to help find a book they presumably could not locate. Libraries calculated fill rate and turnaround time. Although this method simulates a realistic environment, it utilized proxies rather than actual customers. Hebert made only minor changes to SERVQUAL to reflect the context of interlibrary loan services. However, end point labels on the expectations were changed from "strongly agree" and "strongly disagree" to "very important" and "not all that important".

Although Hebert (1993) found a 5-factor structure, these were slightly different from those identified by Parasuraman, Zeithaml, and Berry (1988). The major factor that did not correspond to any of the factors identified by Parasuraman, Zeithaml, and Berry was a dimension Hebert called service fundamentals. This dimension included hours of opening and relevance of the library collection. However, since Hebert's study,

Parasuraman, Zeithaml, and Berry (1994) moved hours of operation to the tangibles dimension. It might also be argued, as Nitecki pointed out, that relevance of the library collection may be considered part of the tangibles dimension. In addition, since Hebert performed factor analysis only on the expectations section of SERVQUAL, it is difficult to compare Hebert's findings to those of Parasuraman, Zeithaml, and Berry, who used both expectations and performance. Hebert claimed that expectation scores are more stable than scores that include perceptions of performance, since performance scores may be more affected by recent service encounters. However, Hebert did not report any results of a factor analysis on the performance scores for comparative purposes.

White, Abels, and Nitecki (1994) measured library service quality with SERVQUAL in two special libraries. White, Abels, and Nitecki used both a modified version of SERVQUAL and an unmodified version of SERVQUAL to compare responses from 142 library users. The modified version of SERVQUAL reflected changes to 3 items. These items pertained to providing services during stated hours, providing clearly written and visually appealing materials associated with services, and insuring that customers feel their transactions will be kept confidential. Three items were added to the instrument, based on feedback from focus group sessions. These items pertained to physical access to information, availability of appropriate staff members to the public, and organization of the collection.

White, Abels, and Nitecki (1994) found that the means for over half the expectation items were over 6 on a 7-point scale, making it difficult for any library to score positively using difference scores. These results are not unusual and reflect one of

the reported problems with SERVQUAL. White, Abels, and Nitecki suggested that any interpretation of data using difference scores in SERVQUAL should be augmented with mean perception and expectation scores for each item and dimension.

White, Abels, and Nitecki (1994) found reliability coefficients lower than those reported in other SERVQUAL studies, with alphas ranging from 0.66 to 0.84 for the modified version of SERVQUAL and 0.66 to 0.81 for the unmodified SERVQUAL. Discriminant validity was tested by analyzing the dimensionality of the instrument, and predictive validity was tested by examining the extent to which judgments on the dimensions predicted overall quality. Factor analysis was performed on the difference scores, the expectation scores, and the performance scores. Analysis was constrained to 5 factors, using an oblique rotation. The factor structure of the difference scores did not match the factor structure hypothesized by Parasuraman, Zeithaml, and Berry (1988). Although the difference scores exhibited a 5-factor solution, it was not the same structure as found by Parasuraman, Zeithaml, and Berry. A 6-factor solution was found for the expectation scores, and a 13-factor solution for the performance scores. These findings are consistent with the varying dimensions reported in other SERVQUAL studies and suggest a problem with varying dimensionality and discriminant validity.

In spite of the problems reported with discriminant validity, White, Abels, and Nitecki (1994) asserted that part of the problem in their findings may have been due to atypical samples, or samples that were too small and differences in the service environment. Customers in special libraries are usually part of the same organization and do not pay for the service, so they may not be as critical in their evaluation of service,

according to White, Abels, and Nitecki, and they may tend to score items high. White, Abels, and Nitecki also included a "no basis for judgment" category for the performance items, and this made it difficult to analyze difference scores when respondents selected this alternative.

Predictive validity was assessed by regressing items on overall service quality rated on a 10-point scale. Previous studies have indicated that performance scores alone have better predictive validity than difference scores based on perceptions minus expectations, and the same pattern was found by White, Abels, and Nitecki (1994). A regression analysis using only perception scores resulted in an R^2 value of 0.75 compared to 0.42 of the weighted difference scores and 0.37 of the difference scores that were not weighted.

Nitecki (1995) used SERVQUAL to examine 3 types of services within the same academic library. These services included interlibrary loan, reference, and reserve. Nitecki's study represents a large sample of library users with a total of 351 responses. Nitecki made only minor changes to the wording on SERVQUAL, but changed the end points on the expectation section from "strongly disagree" and "strongly agree" to "not at all essential" and "absolutely essential." Nitecki added two open ended questions that asked respondents to identify any other expectations related to excellent library service and to list any other factor they considered important in evaluating the quality of library service. The additional items that were identified by respondents clearly fell within one of the 5 dimensions of SERVQUAL identified by Parasuraman, Zeithaml, and Berry (1988), according to Nitecki. None of the statements were judged as "not at all essential", which Nitecki said indicated face validity for the instrument.

Nitecki (1995) reported reliability alphas that ranged from a low of 0.69 for the tangibles dimension to 0.86 for the reliability dimension, based on the use of difference scores. These are somewhat lower than reliability scores reported in other service agencies, but consistent with those reported in libraries by White, Abels, and Nitecki (1994). A 3-factor structure was found by Nitecki, based on factor analysis of the difference scores. Nitecki (1995) suggested that the different results could have stemmed from the use of the "no basis to judge option" which resulted in incomplete data for calculation of the difference scores. In order to avoid this problem, Nitecki also performed factor analysis on the expectation scores, similar to Hebert (1993). This resulted in a 4-factor structure with some overlap between responsiveness and reliability, and even more overlap between responsiveness, assurance and empathy dimensions.

Van Rooijen (1998) and Srisa-Ard (1997) used a SERVQUAL instrument similar to that used by Nitecki to measure service quality in academic libraries in Canada and Thailand. These recent library studies underscore the need to examine whether SERVQUAL or a performance-based version of SERVQUAL, such as SERVPERF, is a more effective measure of library service quality.

Maddox-Swan (1998) was one of the first library researchers to directly compare a difference-based version of SERVQUAL to SERVPERF. Recently, Jenkins (1999) used SERVPERF to have information professionals rate quality of a medical information system, but did not compare SERVPERF to SERVQUAL. Maddox-Swan examined which instrument was a better measure of satisfaction with information services rather than a better measure of overall service quality. Although results indicated no significant

difference in overall customer satisfaction scores between the two instruments, SERVPERF was more strongly correlated to customer satisfaction with services than SERVQUAL. Maddox-Swan found support for six dimensions using difference scores, but did not report a factor analysis of the performance scores. Through focus group interviews, Maddox-Swan did not identify any service quality dimensions applicable to libraries other than the dimensions identified by Parasuraman, Zeithaml, and Berry (1988).

It is important to note that although most of the major studies using SERVQUAL to measure library service quality acknowledged problems with the instrument, each used an early form of the instrument and made few modifications. Only Coleman, Xiao, Bair, and Cholett (1997) used the 1994 version of SERVQUAL.

Measuring library success has proven equally as problematic for libraries as measuring service quality. As in the case of information system success, most studies examined only 1 or 2 variables related to library success. These variables included impact on the individual (Marshall, 1993); cost benefit analysis (Williams, 1988; King et al., 1984); and customer satisfaction (Garlick & Hoegh-Guldberg, 1998; Jardine, 1995; Perrault & Arseneau, 1995; D'Elia & Walsh, 1983; Coffindaffer, 1987). Although some of these variables are related to those used to measure information system success, there has apparently been no specific attempt to use variables related to information center and information system success as measures of library success.

Magal (1991) modified an instrument for measuring information system success and applied it to information centers. Brancheau and Wetherbe (1985) identified the main function of an information center as providing support for end-user computing. The most

important services provided by information centers are technical support, consulting and training (Brancheau & Wetherbe). Libraries provide support to end users in regard to information seeking rather than support for specific hardware or software applications. Some libraries may provide support for hardware or software as part of the information retrieval process, but the primary goal for most libraries is to facilitate end users obtain information. As part of this process, libraries provide very similar services as those of information centers. Because of this, Magal's instrument for measuring information center success seems applicable to libraries. Magal proposed a model of information center success based on 3 dimensions: quality of information center staff service, user self-sufficiency, and quality of user-developed applications. If information quality is substituted for quality of user-developed applications, this model should also apply to libraries.

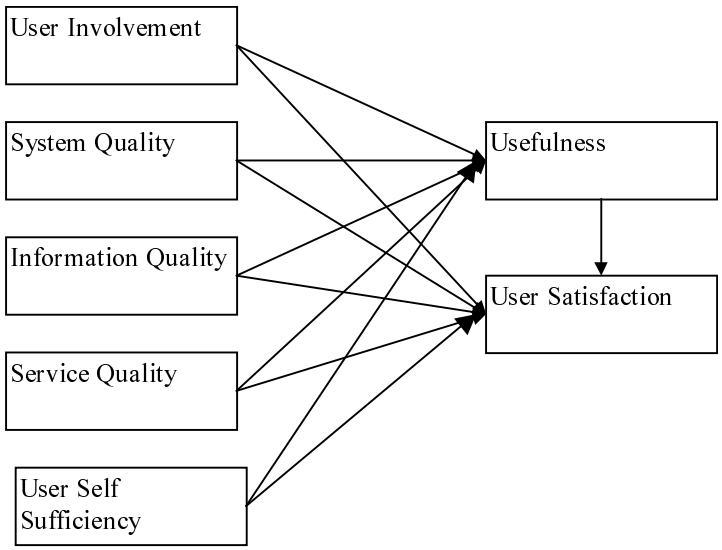


Figure 5: Model of Library Success.

The corresponding dimensions that appear applicable to library success, then, are: quality of library staff service, quality of information, and user self-sufficiency.

Since user satisfaction has been identified as one of the primary variables used to indicate information system success (Pitt, Watson, & Kavan, 1995), it is particularly important to examine how other variables, such as service quality, may influence user satisfaction. If Magal's model of information center success is combined with Seddon and Kiew's model of information system success and modified to apply to libraries, there appear to be 6 variables that may influence user satisfaction in libraries. Figure 5 shows a model of library success based on a combination of the Magal and Seddon and Kiew models. This model of library success suggests that user involvement, system quality, information quality, service quality, user self-sufficiency, and usefulness will all influence the amount of library user satisfaction. It also suggests that user involvement, system quality, information quality, service quality, and user self-sufficiency will influence user perceptions of library usefulness. Ferguson and Zawacki (1993) conjectured that service quality is a critical success factor for information system organizations, and Magal (1991) has shown that service quality is an important factor in influencing information center success. It should be possible, then, to gauge how much service quality contributes toward library success by combining service quality with other variables that influence user satisfaction with information centers and information systems.

CHAPTER 3

MATERIALS AND METHODS

Introduction

A non-experimental research design was utilized in this study. One of the objectives of the research was to test a modified version of SERVQUAL to determine how well it measures library service quality. The other main objectives were to test whether instruments developed to measure information center success and information system success can be used to measure library success, and to determine whether service quality contributes to library success. In order to accomplish this, an instrument developed by Magal (1991) for measuring information center success and an instrument developed by Seddon and Kiew (1994) for measuring information system success were combined with SERVQUAL, and a survey of library users was performed.

Library Service Quality Instrument

The 1994 version of SERVQUAL was selected for use in this study since it represents the latest changes to the instrument proposed by Parasuraman, Zeithaml, and Berry (1994). The 1994 version of SERVQUAL consisted of three 9-point scales anchored at the end points with "low" and "high". The number of items on the instrument was reduced from 22 in the 1988 version to 21 in the 1994 version of SERVQUAL. The item that was dropped pertained to maintaining error-free records. Items were rated on the minimum acceptable level of service, the desired service level, and the perceived performance level.

In the current study, several modifications were made to the 1994 version of SERVQUAL in order to examine specific problems that have been reported with previous versions of the instrument. Nine point scales were reduced to 7. Respondents were asked to rate the importance, desired service level, and the perceived performance of each service attribute by circling a number ranging from a low of 1 to a high of 7. Respondents were also asked to rank the importance of the 5 dimensions of SERVQUAL by assigning a number between 1 and 100. Respondents were not asked to rate minimum acceptable level of service.

The column heading for desired service was changed to read "What an excellent library can and should deliver", to reflect the wording used by Parasuraman, Zeithaml, and Berry (1994). Other column headings read “How important this feature is to me” and “How the library performs here.” Wording for each of the items was kept as close as possible to the 1994 version of SERVQUAL. Only one item was changed from “Visually appealing materials associated with the service” to “Visually appealing documentation, such as library signs, handouts and brochures.” This change was made to clarify the item, based on results of beta testing the instrument.

A fourth column was included with the heading “unknown”. Respondents were instructed to circle the number under “unknown” if they were unsure how to rate the library’s performance for one of the service attributes listed. In the 1994 version of SERVQUAL, Parasuraman, Zeithaml, and Berry included a column headed “no opinion” that allowed respondents to choose not to rate performance on a particular service attribute. Some researchers have advocated the use of a “no opinion” or “don’t know”

choice in order to decrease uninformed responses (Hawkins & Coney, 1981; Hughes, 1969).

Service quality was calculated using performance-only scores and difference scores based both on performance minus expectation ratings and performance minus importance ratings. Separate service quality scores with SERVQUAL are usually calculated for each dimension by summing respondent ratings for each item within the dimension and dividing the sum by the number of items in the dimension. Service quality was calculated in this manner for each dimension using performance-only scores and difference scores based on performance minus expectations and performance minus importance. The dimensions were labeled TAN for tangibles, REL for reliability, RES for responsiveness, ASSURE for assurance, and EMP for empathy. Each type of score was appended to each dimension label. For example, the performance scores for the tangibles dimension were labeled TANP, the performance minus expectation scores for the tangibles dimension were labeled TANPE, and the performance minus importance scores for the tangibles dimension were labeled TANPI.

In order to assess the capability of each method of calculating service quality to measure library service quality, a summary measure of library service quality was added to the instrument. Each respondent was asked to rate the overall quality of service provided by the library on a 7-point scale ranging from poor to excellent. This rating was labeled SERVICE. Satisfaction with the library was calculated two ways. One was by averaging scores on 4 questions developed by Seddon and Yip (1992) that pertain to satisfaction with information systems. Respondents were asked to rate how adequate, effective, and

efficient the library is, and to indicate their level of satisfaction with the library on a 7-point scale. This score was labeled AVLIBSAT. Since one of these 4 questions asked respondents to rate satisfaction with the library as a whole, this question was also scored separately in order to compare results with previous studies. This score was labeled LIBSAT to distinguish it from AVLIBSAT. Respondents were also asked to rate overall satisfaction with library service to determine if there was any difference between asking respondents to rate overall library service and asking respondents to rate overall satisfaction with library service. This score was labeled SERVSAT to distinguish it from SERVICE.

The items pertaining to SERVQUAL were mapped to 5 service quality dimensions as shown in Table 1, where the item numbers correspond to items in Section A of the questionnaire. This mapping reflects the changes made to SERVQUAL by Parasuraman, Zeithaml, and Berry in 1994.

Table 1.

SERVQUAL Item to Dimension Map

Dimension	Label	Section	Item Number
Tangibles.	TAN	A	items 1-5
Reliability	REL	A	items 6-10
Responsiveness.	RES	A	items 11-13
Assurance	ASSURE	A	items 14-17
Empathy.	EMP	A	items 18-21

Two open-ended questions pertaining to service were included on the pilot survey instrument. One asked respondents to identify any other services they expected or desired

in excellent libraries. Another asked respondents to identify any other feature they considered important in evaluating the quality of library service. Since the responses to these two questions were nearly identical in the pilot survey, one of the questions appeared to be redundant and was subsequently eliminated. The question on the final version of the survey asked respondents to identify any other service they expected or desired in excellent libraries.

Library Success Instrument

An instrument developed by Magal (1991) to measure information center success and an instrument developed by Seddon and Kiew (1994) to measure information system success were combined to measure library success. Only minor modifications were made to the wording of the items to pertain to libraries. The instrument used by Magal and the instrument used by Seddon and Kiew are similar, and both were derived from an instrument originally developed by Bailey and Pearson (1983) to measure user information satisfaction. The difference between Magal's instrument and Seddon and Kiew's instrument is that Seddon and Kiew added 3 factors that pertained to information system success: system quality, usefulness, and user involvement.

Magal (1991) had respondents rate importance and performance on a 7-point scale ranging from low to high. Since this is the same scale that was utilized by SERVQUAL, consistency was preserved, and it was possible to directly compare SERVQUAL to Magal's instrument. Magal had respondents rate items pertaining to staff service quality, quality of user-developed applications, and user self-sufficiency. Magal stated that the quality of user-developed applications dimension is analogous to the information product

dimension defined by Ives, Olson, and Baroudi (1983) from the Bailey and Pearson (1983) instrument. Since libraries are usually more concerned with providing support for information rather than developing user applications, the items on the instrument used in this study were modified to refer to the quality of information received by the user. The items reflect aspects of information quality that were used on the Bailey and Pearson instrument, which consisted of accuracy, precision, reliability, completeness, currency, and relevance of information. Although relevance and currency of information received were not on Magal's instrument, these items were on the Bailey and Pearson instrument. Since these two aspects of information might be important to library customers, they were added to the library success instrument. A library information quality score (INFOQUAL) was calculated by summing responses to these 6 items and dividing the sum by the number of items in the dimension.

Magal (1991) included a factor pertaining to user self-sufficiency or user independence. Magal stated that this factor is related to the involvement factor on the Ives, Olson, and Baroudi (1983) instrument that evolved from the Bailey and Pearson (1983) instrument to measure user information satisfaction. The items from this factor related to user participation and feelings of control. Seddon and Kiew (1994) separated involvement from user participation, citing a study by Barki and Hartwick (1989) that suggested the two are different constructs. User participation is defined as how much the user participates in the development process, whereas involvement is defined as how important and personally relevant the user considers the system (Seddon & Kiew). Although library users do not normally participate in the development process of a library

system, the concepts of involvement and user self-sufficiency are applicable, and should be included on an instrument to measure library success. User self-sufficiency or independence is an especially important concept for libraries to measure because of recent pressure for libraries to focus on greater user independence (Etgar, 1979; Fore, Knight, & Russell, 1993). For these reasons, 5 items pertaining to user self-sufficiency were included on the library success instrument. A user self-sufficiency score (SELFSUF) was calculated by summing responses to these 5 items and dividing the sum by the number of items in the dimension.

On Magal's instrument, 7 items pertained to staff service quality. All of these were incorporated into the library success instrument. During beta testing of the instrument, minor changes were made to two items to clarify their wording. These pertained to relations between users and staff and attitude of the staff. Since Magal's instrument is based on an instrument developed by Bailey and Pearson (1983), the wording was changed to more closely reflect how Bailey and Pearson worded these two items. The item pertaining to staff relations was modified to refer to "good" staff relations, and the item pertaining to staff attitude was modified to refer to "cooperative" staff attitude. A library staff service quality score (STAFFSRV) was calculated by summing responses to these 7 items and dividing the sum by the number of items in the dimension.

Although some of the items pertaining to staff service quality on Magal's instrument are similar to some of the items on SERVQUAL, the full version of both instruments was used rather than eliminating redundant items. Several subjects commented during beta testing of the instrument that some items were repetitious. However, in order to

compare results with previous studies, and to examine how the two instruments related, both instruments were used in their entirety. Hence, both instruments were essentially the same as those used by Kettinger and Lee (1994) to compare SERVQUAL with the instrument developed by Baroudi and Orlikowski (1988) to measure user satisfaction with information services. The only difference was that Kettinger and Lee included an item pertaining to the time required to develop and implement new systems. Since most libraries do not develop and implement systems for users, this item was not included on the library success instrument.

Four items pertaining to system quality were included on the library success instrument. Seddon and Kiew (1994) interpreted system quality as referring to how user friendly or easy a system is to use. In most libraries, the only contact customers have with the library's computer system is through the online public access catalog. For that reason, questions pertaining to system quality were modified to refer to the library's online public access catalog. Respondents were asked to rate the quality of the library's online catalog using the same 7-point scale used in other sections of the instrument. The items pertaining to the quality of the library's online catalog were taken from an instrument developed by Davis (1989) to measure perceived ease of use of an information system. A system quality score (SYSQUAL) was calculated by summing responses to these 4 items and dividing the sum by the number of items in the dimension.

Six items pertaining to library usefulness were included in Section B of the library success instrument. Respondents were asked to rate library usefulness by indicating agreement or disagreement on a 7-point scale with 6 statements pertaining to how useful

the library was to their research and productivity. These items were taken from an instrument developed by Davis (1989) to measure perceived usefulness of an information system. Library usefulness (LIBUSFL) was calculated by summing responses to these 6 items and dividing the sum by the number of items in the dimension.

Respondents were asked to indicate their involvement with the library in section E of the library success instrument using a semantic differential scale developed by Zaichkowski (1985). The semantic differential scale was anchored at each end by bipolar adjectives, such as important and unimportant. Six items describing facets of individual involvement were used. Respondents were asked to put a check mark in the space closest to the adjective that described their opinion of the library. The scale was divided into 7 unnumbered blocks and was scored 7 if rated in the block nearest the positive adjective and 1 if rated in the block nearest the negative adjective. Library involvement (LIBINVLV) was calculated by summing the responses to these 6 items and dividing the sum by the number of items in the dimension. The items on the library success instrument were mapped to 6 dimensions of library success as shown in Table 2.

Table 2.

Library Success Item to Dimension Map

Dimension	Label	Section	Item Number
Usefulness	LIBUSFL	B	items 1-6
Staff Service	STAFFSRV	C	items 1-6 and 8
Information Quality	INFOQUAL	C	items 9-14
User Self-Sufficiency	SELFSUF	C	items 7 and 15-18
System Quality	SYSQUAL	C	items 19-22
Involvement	LIBINVLV	E	item 8

In order to examine differences among library users that might affect perceptions of service quality, respondents were asked to indicate age, gender, and the type of job they performed. Respondents were also asked how many times they had used or requested service from the library, how many times they had used the library's online catalog, and how often they relied on library staff when using the library. Because respondents were taken from an active database of library users at the Vicksburg site, no time period of use was specified on the Vicksburg survey. It is not unusual for an engineer to use the library frequently while working on a project, and then not use the library for several months at a time. Therefore, it appeared more important to know how many times a respondent had used the library regardless of the time frame than to limit use to a specific period of time.

Library users at the Vicksburg site were asked whether they had ever paid for library services with a work item code or job number. Library users at the Vicksburg site sometimes have to pay a database search fee for complex or lengthy searches. Since library users at the Little Rock site are not charged in the same manner, this question was not included on the survey form at that site. In order to assess whether library service quality influenced subsequent behavior, library users were asked to indicate how likely they were to use the library in the future and how likely they were to recommend others to use the library.

Survey Method and Subjects

A mail survey was used to collect data from a population of library users at the U.S. Army Corps of Engineers Waterways Experiment Station (WES), in Vicksburg, MS, and the U.S. Army Corps of Engineers Little Rock District Office in Little Rock, AR.

Both sites have similar missions. The research areas encompass environmental studies, coastal engineering, soils analysis, concrete and dam structure analysis, and hydraulics. The customer base at both sites is nearly identical, consisting primarily of government engineers, scientists, and support staff. The major difference between the two sites is size. Based on information supplied to the author by the Headquarters Office of the U.S. Army Corps of Engineers, the number of federal employees at Vicksburg is 1,228 and the number of employees at Little Rock is 765. Of the total number of employees, about 45% of the work force are engineers at Vicksburg and about 28% of the work force are engineers at Little Rock. At Vicksburg, about 69% of the work force are men, and at Little Rock about 71% of the work force are men. The mean age of the worker at Vicksburg is 45, and the mean age of the worker at Little Rock is 44.

The difference between the Vicksburg and Little Rock libraries is mainly size. The mission of the two libraries is to provide support for both scientific and legal research related to U.S. Army Corps of Engineers projects. The work is typical of most corporate or special libraries. Library use is voluntary at both sites. There are no direct charges for using the library, except when performing lengthy, fee-based database searches. However, each laboratory or agency is assessed an overhead fee for library operation, so most users are aware there are costs associated with providing library service. Library services offered at both sites include ordering books and article reprints for customers, checking books in and out for customers, requesting interlibrary loans for customers, routing journals, and providing search assistance in various online databases. The Vicksburg library has a larger collection and staff than the Little Rock library. The Vicksburg library

has provided a local online catalog for the past 8 years, whereas the Little Rock library did not obtain a local online catalog until 1997.

Because of the similarities in the mission and the work force, the Little Rock library was selected as a pilot test for the larger survey at Vicksburg. The chief librarian at the Little Rock library estimated there were 300 library users at Little Rock. The chief librarian drew 150 users randomly and mailed a survey form with a cover letter signed by the head of the U.S. Army Corps of Engineers library program to each user in January 1998. A copy of the Little Rock cover letter is shown in Appendix A, and a copy of the Little Rock survey instrument is shown in Appendix B. Respondents were instructed to return the completed survey form in a sealed envelope to the chief librarian at the Little Rock library. Respondents were asked not to write their name on the questionnaire and were assured that all responses would be treated anonymously. The chief librarian at the Little Rock library gathered all returned survey forms and mailed them to the author.

The survey form used in the pilot study at the Little Rock library was nearly identical to the survey form used in the subsequent survey at Vicksburg. The only difference between the survey forms was that the Little Rock survey did not ask respondents to rate convenience of access or ask whether they had paid for specific services with a job number. Initially, it appeared that asking respondents to rate convenience of access was essentially the same as asking respondents to rate convenient hours of operation. However, when hours of operation was substituted for convenience of access on the library success pilot instrument, reliability analysis indicated that the scale mean and scale alpha would be considerably higher without this item. A correlation matrix

also indicated that hours of operation had the lowest correlation with the other service items on the library success instrument, ranging from 0.28 to 0.44. Furthermore, when the library success instrument used on the pilot test was factor analyzed, hours of operation had a low communality score, 0.29, and was the only item with a loading less than the conventional 0.50. This suggested that convenience of access should be considered separately from convenient hours of operation, so convenience of access was included as a separate question on the subsequent survey at Vicksburg.

The Vicksburg library database contained 945 registered library users at the time of the survey. These registered library users consisted of personnel who had checked out or in at least one item through the library. Respondents from this database were considered qualified to evaluate the level of library service being offered at Vicksburg. A population of 1,000 users requires a sample size of 278 to provide a confidence level of 95% with an acceptable error of 0.05 (McCall, 1982). However, since Cohen (1988) recommended using 5 respondents per survey item when performing a factor analysis, and the survey questionnaire consisted of 72 items, 360 respondents were needed to meet Cohen's guidelines. Since the response rate could not be predicted, an estimated 40% response rate was assumed. In order to insure a response from at least 360 users, a copy of the survey was mailed to all 945 registered users in the Vicksburg library database.

A cover letter signed by the WES director, Dr. Robert Whalin, was attached to the survey and sent through inter-office mail to each registered library user at Vicksburg in April of 1998. A copy of the Vicksburg cover letter is shown in Appendix C, and a copy of the Vicksburg survey instrument is shown in Appendix D. Respondents were instructed

to remove the cover letter and return the completed survey form in a sealed, self-addressed envelope. Respondents were asked not to write their name on the questionnaire and were assured that all responses would be treated anonymously.

Procedure for Analysis

The SERVQUAL instrument was evaluated for validity and reliability using both performance and difference scores. In order to compare performance and difference scores with previous studies, both were first subjected to a reliability test using Cronbach's alpha. Reliability refers to the degree of internal consistency of an instrument (Kerlinger, 1986), and Cronbach's alpha is commonly used to assess reliability. Hence, Cronbach's alpha was used in the initial analysis in order to compare results with previous studies that used Cronbach's alpha to test reliability. However, Cronbach's alpha is not considered the appropriate measure of reliability for a difference score (Van Dyke, Kappelman and Prybutok, 1997), so a modified alpha formula recommended for use with difference scores by Stanley (1967) and Johns (1981) was also used to test reliability. The method of calculating library service quality that exhibited the highest alpha values was considered to be the most reliable. Alpha scores were calculated for both the overall scale, to measure the internal consistency of the items within the entire scale, and for each dimension, to measure the internal consistency of the items within each dimension.

Construct validity is established by showing that the instrument measures the construct it is intended to measure. Construct validity was evaluated two ways. First, the correlation between performance scores and an overall measure of library service quality, and the correlation between difference scores and an overall measure of library service

quality was measured. The type of score that exhibited the highest correlation with an overall measure of library service quality was considered to possess greater construct validity. Second, a factor analysis was performed on both performance and difference scores to examine whether the method of calculating library service quality affected SERVQUAL's dimensional structure, and whether the different measures of service quality loaded onto the factors as described by Parasuraman, Zeithaml, and Berry (1994).

Construct validity was further evaluated following guidelines for measuring convergence and discrimination proposed by Bagozzi (1981). Bagozzi suggested that correlations for items within a dimension should be high, and that correlations for items across dimensions should be lower than the correlations within dimensions. Convergent validity refers to how well different scale items indicate the same or similar constructs, and how well multiple measures of the same construct agree with each other (Kerlinger, 1985). Convergent validity of performance and difference scores was assessed by measuring the extent items correlated with items in the same factor or dimension. High correlations among items within each factor were considered to indicate convergent validity.

Discriminant validity refers to how well scale items differentiate between separate constructs (Kerlinger, 1985). Discriminant validity was assessed by counting the number of times an item had a higher correlation with an item from another factor or dimension than with items in its own factor. The count should be less than half the total potential comparisons, according to Campbell and Fiske (1959).

Criterion-related, or predictive, validity refers to the extent to which a scale is related to conceptually related measures (Parasuraman, Zeithaml, & Berry, 1991). In order to assess the predictive validity of each method of calculating library service quality, performance scores and difference scores were compared in their ability to explain variation in overall library service quality. The respondent's perception of overall library service quality was regressed on the 21 items of the SERVQUAL instrument. A separate regression analysis was performed on performance scores, on performance minus expectation scores, and on performance minus importance scores. The same procedure was used to assess how well performance and difference scores predict library satisfaction by substituting overall library satisfaction as the dependent variable. The method of calculating service quality scores that exhibited the highest adjusted R^2 value was considered to have the highest predictive validity.

Content validity is indicated by internal consistency and correlations of measures with other measures of the construct (Kerlinger, 1985). High item-total correlations, along with high correlations of each measure with an overall measure of library service quality, were considered to indicate content validity. The method of calculating library service quality that displayed the highest item-total correlations and the highest correlation with an overall rating of library service quality was considered to have the highest content validity.

Separate analyses were performed on the library success instrument to evaluate validity and reliability in a manner similar to that used on the SERVQUAL instrument. The major difference was that only performance scores on the library success instrument were

used for analysis. Also, since different factors were involved, separate analyses were performed on the portion of the library success instrument that consisted of the information center success instrument and on the portion that consisted of the information system success instrument. This was done in order to compare results to those found in previous studies. Additional analysis was subsequently performed on the combined instruments.

Construct validity of the library success instrument was assessed two ways. First, correlations between overall library satisfaction and each performance measure relating to service quality, information quality, system quality, user self-sufficiency perceived library usefulness, and library involvement were examined. High correlations were considered to indicate construct validity. Second, a factor analysis was conducted on the different measures of library success to determine if they loaded onto the factors as theorized by Magal (1991) and Seddon and Kiew (1994).

Construct validity was also evaluated by measuring convergence and discrimination. Convergent validity was assessed by measuring the extent items correlated with items in the same factor or dimension. High correlations among items within each factor were considered to indicate convergent validity. Discriminant validity was assessed by counting the number of times an item had a higher correlation with an item from another factor than with items in its own factor. A count of less than half the total potential comparisons was considered to indicate discriminate validity.

Criterion-related, or predictive, validity was assessed by regressing the respondent's perception of overall library satisfaction on the individual scores of the library

success instrument. If the scores accounted for most of the variation in overall library satisfaction, the instrument was considered to have high predictive validity. Content validity was assessed by examining item-total correlations and by examining correlations of the library success measures with an overall measure of library satisfaction. If items on the library success instrument displayed a high correlation with an overall rating of library satisfaction, it was considered to indicate content validity.

Reliability of the library success factors was measured using Cronbach's alpha. Since no difference scores were calculated on the library success instrument, John's alpha was not used. If the scores exhibited a high alpha value, the instrument was considered to have high reliability. High reliability and validity of the library success instrument was considered to indicate that Magal's information center success instrument and Seddon and Kiew's information system success instrument were suitable for use in measuring library success.

The difference between importance and expectation scores in SERVQUAL was evaluated by determining if there was a significant difference between the mean importance and mean expectation ratings, and if there was a difference in standard deviation between the scores. The score that exhibited a lower rating and a higher standard deviation was considered better for use as a difference score, since it would result in a less negative service quality score and less variance restriction. The reliability of performance minus expectations and performance minus importance scores was assessed using Cronbach's alpha. The difference score that exhibited the highest alpha was considered more reliable. The validity of performance minus expectations and performance

minus importance scores was assessed by determining the correlation between each type of score and a measure of overall library service quality. Performance minus expectations and performance minus importance scores for each dimension were also regressed on library service quality to determine which type of score was a better predictor of library service quality. The difference score that exhibited the highest R^2 value was considered the better predictor of library service quality.

To examine how rating the importance of SERVQUAL's dimensions differs from rating individual items on SERVQUAL, respondents were asked to rate both the dimensions and individual items. Respondents were asked to rate the importance of each item from a low of 1 to a high of 7. Respondents were also asked to rate the importance of each of SERVQUAL's 5 dimensions by assigning a total of 100 points among the dimensions. In order to compare the ratings by dimension, the importance rating of each item was summed within each dimension and the sum was divided by the number of items in that dimension. The mean item score for each dimension was then compared to the mean points assigned to each dimension by respondents.

To determine whether SERVQUAL is measuring library service quality or library satisfaction, a regression analysis was performed, first, with overall library service quality as the dependent variable, and second with overall library satisfaction as the dependent variable. A regression analysis was run against both performance and difference scores to compare how well each type of score predicted library service quality or library satisfaction.

T-tests were used to determine if differences existed between the average SERVQUAL performance ratings among respondents by gender, occupation, age, frequency of library use, and reliance on library staff. In order to determine occupation category, respondents selected from one of 5 job titles: engineer, scientist, technician, administrative, and other. Since information use studies have indicated that engineers may seek and use information differently from other occupations (Allen, 1977), respondents were classified into two broad groups, engineers and non-engineers. Frequency of library use was determined through respondent estimates of the number of times they had used the library or requested library service. Library users were considered frequent users if they had used the library more than 6 times. Reliance on library staff was determined by respondent estimates on how frequently they relied on library staff when using the library. Library users were considered reliant upon library staff if they reported relying upon the library staff at least frequently.

T-tests were used to determine if differences existed between the average SERVQUAL performance ratings among respondents who rated the library high in usefulness and library service high in value. Library users were separated into two groups for analysis. Respondents who had an average library usefulness rating of 5 or higher on a scale of 1 to 7 were considered to rate the library high in usefulness, while respondents who had an average library usefulness rating of less than 5 were considered to rate the library low in usefulness. Respondents who had an average library service value rating of 5 or higher on a scale of 1 to 7 were considered to rate library service high in value, while

respondents who had an average library service value rating of less than 5 were considered to rate library service low in value.

The association between library users' ratings of perceived library service quality and the tendency to use the library in the future was determined by measuring the correlation between library service quality performance ratings and respondent ratings of the likelihood of using the library in the future. The association between ratings of perceived library service quality and the tendency to recommend the library to others was determined by measuring the correlation between library service quality performance ratings and respondent ratings of the likelihood of recommending the library to others. Library users indicated on a scale of 1 to 7 how likely they were to use the library in the future or to recommend others to use the library.

To compare SERVQUAL with the library success instrument, and to determine if there were dimensions found in SERVQUAL that were not were not captured by any dimension of the library success instrument, a methodology was followed similar to that used by Kettinger and Lee (1994). Since the library success instrument used in this study incorporates the same items as the instrument used by Kettinger and Lee, it was considered possible to compare results to the Kettinger and Lee study. First, a confirmatory factor analysis using AMOS, a structural equation modeling program, was performed on each instrument to establish validity of the two models, and to show the association between them. Structural equation models are models of relationships among variables that encompass and extend regression and factor analysis procedures (Hayduk, 1987; Bollen, 1989). Next, an all-possible regression procedure was performed on the

variables making up the library success instrument and SERVQUAL to determine if a combination of both instruments is a better predictor of library satisfaction than either instrument alone. A second regression model was used to determine if a combination of both instruments is also a better predictor of library service quality than either instrument alone.

Based on the results of the comparison between SERVQUAL and the library success instrument, a model of library success was tested following a procedure used by Seddon and Kiew (1994) to test a model of information system success. First, an all-possible regression analysis was performed with library satisfaction as the dependent variable on library service quality, system quality, information quality, usefulness, user self-sufficiency, and user involvement. Library service quality consisted of 7 items from Section C of the library success instrument pertaining to staff service quality and 5 items from Section A pertaining to the reliability dimension of SERVQUAL. The dependent variable, library satisfaction (AVLIBSAT), consisted of 4 items pertaining to adequacy, effectiveness, efficiency, and overall library satisfaction. The highest adjusted R^2 value was considered to indicate the best model for library success. Each variable was then entered into a second regression analysis to determine if increases in library usefulness, involvement, user self-sufficiency, system quality, information quality, and service quality contributed to increases in library satisfaction. Standardized beta coefficients and t-values were examined to determine the relationship between these variables and how much each variable contributes to library satisfaction. High standardized beta coefficients and t-values were considered to indicate which variables were strong predictors of library satisfaction.

A separate regression analysis was performed on library service quality, system quality, information quality, user self-sufficiency, and user involvement, with usefulness as the dependent variable. Standardized beta coefficients and t-values were examined to determine the relationship between these variables and how much each variable contributes to library usefulness. High standardized beta coefficients and t-values were considered to indicate which variables were strong predictors of library usefulness. All significance values listed in the analysis of the survey results were reported as 2-tailed, since no direction was assumed.

CHAPTER 4

RESULTS

The survey data that was obtained in this study is reported in this chapter. A complete analysis and discussion of these results is presented in Chapter 5.

Mail Response Results

At Little Rock, 150 survey forms were mailed, and 91 survey forms were returned, resulting in a response rate of 61%. Of the survey forms returned, 5 were discarded because they were incomplete, leaving 86 useable survey forms, or 57%. All of the responses were received within a two-week period, so no follow-up letter was considered necessary. At Vicksburg, 945 survey forms were mailed, but 31 survey forms were returned as undeliverable due to resignations and changes of duty stations. The total survey forms returned was 310, resulting in a response rate of 33%. Of the survey forms returned, 11 were discarded because they were incomplete, leaving 299 useable survey forms, or 32%.

Over half the useable responses, 166, were received within two weeks of the initial mailing at Vicksburg. A follow up letter personally signed by the WES Director at Vicksburg was sent after 4 weeks. This resulted in another 133 useable responses. A t-test was performed on early and late response groups, and there was no significant difference between mean ratings of importance, expectation, or performance. Some respondents commented that they had not noticed that the survey was initiated locally, so they had ignored the first request. The difference in response times between Little Rock and

Vicksburg could have been partially caused by the larger number of surveys sent at Vicksburg and the wider distance between offices. Employees at the Little Rock site are primarily located in a single building in close proximity to the library.

Since both survey instruments were virtually the same, the results of the pilot test at Little Rock were combined with the results of the survey at Vicksburg in order to obtain a larger number of responses for analysis. A population of 1,300 users, the total estimated number of library users at Little Rock and Vicksburg, requires a sample size of less than 322 to provide a confidence level of 95% with an acceptable error of 0.05 (McCall, 1982). Combining the surveys yielded 385 responses. This was considered sufficient to meet McCall's sample size requirements as well as the 5 respondents per survey item recommended by Cohen (1988).

Out of a total of 1,095 survey forms sent out to library users at both sites, the combined returns represent a response rate of 37%. Although the overall response rate is low, this response rate does not appear to be unusual for SERVQUAL mail surveys. White, Ables, and Nitecki (1994) reported a 39% response rate with a SERVQUAL mail survey at one special library. A number of other mail surveys using SERVQUAL have reported response rates below 30% (Parasuraman, Zeithaml, & Berry, 1994; Parasuraman, Zeithaml, & Berry, 1991; Babakus & Boller, 1992).

Respondent Characteristics

At Vicksburg, 74% of the responses were from men, and at Little Rock, 61% of the responses were from men. Based on statistics furnished by the U.S. Army Corps of Engineers Headquarters Office, this percentage is close to the percentage of men in the total work force at both sites.

At Vicksburg, 43% of the responses were from engineers. This percentage is very close to the percentage of engineers in the total work force at Vicksburg, about 45%. At the Little Rock site, 41% of the responses were from engineers. This percentage is higher than the percentage of engineers in the total work force at the Little Rock site, about 28%. The high percentage of responses from engineers at both sites indicates that engineers are the predominant library users at these locations.

About 46% of the respondents at Vicksburg were below the age of 45, and about 37% of the respondents at Little Rock were below the age of 45. There were very few workers at either site below 25 or over 65 years of age, less than 2%.

Based on these percentages, it appears that the responses at Vicksburg and Little Rock are representative of the work force as a whole at both sites. The distribution by gender, job type, and age at both sites is shown in Tables 3 through 5.

Table 3.

Distribution of Respondents by Gender

Site	Gender	n	% of Respondents	% in Work Force
Vicksburg	Males	222	74	69
	Females	74	25	31
	Data Missing	3	1	
Little Rock	Males	52	61	71
	Females	26	30	29
	Data Missing	8	9	

At Vicksburg, 76% of the respondents indicated they had used or requested service from the library more than 6 times. A similar percentage of the respondents at the

Little Rock site had also used the library more than 6 times, about 85%. At the same time, 77% of the respondents at Vicksburg and 79% of the respondents at Little Rock

Table 4.

Distribution of Respondents by Age

Site	Age	n	% of Respondents	Mean Age of Work Force
Vicksburg	Below 25	4	1	45
	25-45	136	46	
	45-65	153	51	
	Above 65	3	1	
	Data Missing	3	1	
Little Rock	Below 25	0	0	44
	25-45	32	37	
	45-65	42	49	
	Above 65	0	0	
	Data Missing	12	14	

Table 5.

Distribution of Respondents by Job Type

Site	Job Type	n	% of Respondents	% in Work Force
Vicksburg	Engineer	130	43	45
	Scientist	87	29	
	Technician	22	7	
	Administrative	41	14	
	Other	17	6	
	Data Missing	2	1	
Little Rock	Engineer	35	41	28
	Scientist	11	13	
	Technician	1	1	
	Administrative	15	17	
	Other	6	7	
	Data Missing	18	21	

indicated they relied on the library staff at least frequently when they used the library. At Vicksburg, 71% of the respondents indicated they had used the library's online catalog at least twice, whereas only 20% of the respondents at the Little Rock site said they had used the library's online catalog at least twice. This was not unexpected, since the Little Rock District library only recently acquired a local online catalog, and its use is primarily restricted to the library. At Vicksburg, the library's online catalog has been in place for more than 8 years and is accessible from an employee's desktop. At Vicksburg, 68% of the respondents indicated they had paid for library service with a work item code or job number. These results suggest the respondents in this study are well qualified to rate the quality of library service at their location.

Additional Library Services Identified by Users

About 20% of the respondents filled in the open ended question asking users to identify services they expected or desired in excellent libraries in addition to those listed. This compares to about the same percentage of respondents in a study by Nitecki (1995) in which she asked respondents to list additional expectations of library service. Nitecki reported that each item mentioned by respondents corresponded to one of the 5 SERVQUAL dimensions identified by Parasuraman, Zeithaml and Berry (1988). Similar results were found in this study. The majority of added comments pertained to tangibles, such as operating hours, heating, lighting, equipment, or the collection. None pertained to any dimension other than those already identified with SERVQUAL. A few of the comments related to convenience of access to the library. Although there is no specific dimension for access in SERVQUAL, access appears related to physical or tangible factors such as location, parking, hours of operation, and network support. White, Ables,

and Nitecki included items related to convenient library access under the tangibles and empathy dimensions. Parasuraman, Zeithaml, and Berry (1994) moved the item pertaining to hours of operation to the tangibles dimension, suggesting that similar items pertaining to access may be considered part of the tangibles dimension. This indicates that SERVQUAL adequately covers the service quality dimensions in a library environment.

Unknown Ratings

A column was provided for respondents to choose an "unknown" rating. This was done to allow respondents who felt they were not sure how to rate the library's service performance on a particular attribute an option of not responding. Although this option was not provided on SERVQUAL until 1994, Nitecki (1995) reported that about 20% of the respondents in a survey of academic library users reported at least one item "unknown." In this study, about 29% of the respondents rated at least one item "unknown". The two SERVQUAL items that exhibited the highest "unknown" responses pertained to making users feel safe or secure in their transactions with the library and keeping customers informed of when library service will be performed. About 11% of the respondents rated these two items as "unknown". This may have been due to unclear wording of these two questions, or to respondents' lack of experience with these particular service features. Keeping customers informed of when service will be provided was also rated "unknown" by a number of library reference service users in Nitecki's study. Nitecki (1995) suggested this indicated a need for libraries to clearly state timeframes for service deliverables.

Although including a “no response” or “unknown” option for respondents may help reduce response bias, it poses problems when calculating service quality scores. This is especially the case when service quality is calculated as a difference score, since a zero rating is possible. In order to distinguish an item rated as “unknown” from a true zero rating, all items that were marked “unknown” were treated as missing data. Hair et al. (1995) do not consider cases of missing data as high as 30% excessive enough to automatically exclude them from analysis. Only four cases in this study had missing data higher than 30% due to "unknown" ratings. These cases all pertained to system quality performance, and the "unknown" ratings were due to the newness of the system at the Little Rock site. A t-test was performed on responses with missing data and with no missing data to determine if there were any significant differences in the mean scores. No statistically significant differences were found in the mean expectation, importance, and performance scores between responses with missing data and with no missing data, nor were there any statistically significant differences in the mean ratings of overall library service quality and library satisfaction. This suggests that treating the “unknown” cases as missing data does not make a significant difference in the results.

Expectation Ratings

Expectation ratings of the SERVQUAL items are shown in descending order in Table 6. Expectation ratings of the items on SERVQUAL were high and exhibited a negative skew and positive kurtosis, consistent with results of other SERVQUAL surveys. Overall average expectation rating was 6.25, with means of individual items ranging from a high of 6.67 to a low of 5.35. This compares to a mean expectation rating of 6.02 reported by White, Abels, and Nitecki (1994) and 6.40 reported by Smith (1995).

Items rated the highest in expectations pertained to willingness to help users, providing service as promised, readiness to respond to users' requests, staff who have the knowledge to answer users' questions, and dependability in handling users' service problems. Items rated the lowest in expectations pertained to tangibles.

Table 6.

SERVQUAL Expectation Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
WILLINGE	379	6.6728	.6371
PROMISEE	371	6.6011	.7070
READYE	374	6.5615	.7139
KNOWE	378	6.5450	.7530
DEPENDE	369	6.5230	.7555
PROMPTE	378	6.4735	.7573
ATTIMEE	371	6.4717	.7719
FRSTIMEE	375	6.4693	.8001
COURTE	377	6.4668	.8086
HOURSE	378	6.3386	.9078
NEEDSE	373	6.3244	.9125
INTRSTE	362	6.2956	.9639
ATTENTE	375	6.2720	.8990
INFORME	360	6.1972	.9456
CAREE	371	6.1914	.9911
CONFE	366	6.1749	1.0214
SAFEE	354	6.1243	1.0245
MODERNE	369	6.0813	1.1320
NEATE	373	5.5442	1.3285
FACILITE	373	5.4209	1.3329
SIGNSE	363	5.3554	1.3576
Valid N (listwise)	304		

Importance Ratings

Importance ratings of the SERVQUAL items are shown in descending order in Table 7. Importance ratings of the items on SERVQUAL were lower than expectation ratings. Importance ratings also exhibited a higher standard deviation than expectation ratings. Both of these findings are in accord with results reported by Smith (1995).

Table 7.

SERVQUAL Importance Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
WILLINGI	382	6.5916	.7141
PROMISEI	375	6.5120	.7629
READYI	378	6.4339	.7859
KNOWI	382	6.4084	.8170
DEPENDI	373	6.3968	.8153
ATTIMEI	375	6.3627	.8121
FRSTIMEI	378	6.3624	.8326
PROMPTI	382	6.3246	.8064
COURTI	380	6.2684	.9082
INTRSTI	368	6.1087	1.0795
NEEDSI	377	6.0902	1.0275
HOURSI	383	6.0548	1.0876
ATTENTI	379	6.0158	1.0363
INFORMI	361	5.9418	1.0617
CONFI	371	5.8760	1.1836
CAREI	376	5.8723	1.1887
SAFEI	357	5.7675	1.2849
MODERNI	374	5.5722	1.3458
NEATI	379	4.8997	1.4163
FACILITI	377	4.5119	1.4679
SIGNSI	365	4.4877	1.5093
Valid N (listwise)	308		

Overall average importance rating was 5.95. This compares to a mean importance rating of 6.00 reported by Smith. The ranking of the importance items followed an order similar to expectations. The 5 items rated the most important were the same as those that had the highest expectation rating. Items rated the least important pertained to the tangibles dimension.

Table 8.

SERVQUAL Performance Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
WILLINGP	376	6.3378	1.0147
COURTP	374	6.2567	1.0085
READYP	371	6.1779	1.0632
PROMISEP	365	6.0904	1.0613
ATTENTP	370	6.0757	1.0539
FRSTIMEP	367	6.0191	1.0093
ATTIMEP	363	5.9917	1.0603
PROMPTP	373	5.9812	1.0985
DEPENDP	358	5.9777	1.1150
CAREP	368	5.9674	1.0794
KNOWP	372	5.9624	1.0859
INTRSTP	355	5.9549	1.1415
NEEDSP	367	5.8447	1.1620
SAFEP	345	5.7913	1.1399
CONFP	358	5.7765	1.1427
INFORMP	341	5.5894	1.2278
NEATP	367	5.4114	1.2268
HOURSP	372	5.3360	1.2896
MODERNP	358	5.1453	1.2507
SIGNSP	353	4.8045	1.3626
FACILITP	370	4.6000	1.4602
Valid N (listwise)	271		

Performance Ratings

Performance ratings of the SERVQUAL item are shown in descending order in Table 8. Overall average performance rating of the items on SERVQUAL was 5.76, similar to a mean performance rating of 5.73 reported by White, Abels, and Nitecki (1994). Although performance ratings were consistently lower than either the importance or expectation ratings, they exhibited a negative skew and positive kurtosis similar to the importance and expectation scores. Means of individual items ranged from a high of 6.34 to a low of 4.60.

The ranking of the performance items did not follow the same order as either the importance or the expectation ratings. The 5 performance items rated the highest pertained to willingness to help users, courteous staff, readiness to respond to users' requests, providing service as promised, and giving users individual attention. These items represented dimensions pertaining primarily to responsiveness and assurance. The performance items rated the lowest pertained to the tangibles dimension, similar to the importance and expectation items.

SERVQUAL Scores by Dimension

Since SERVQUAL scores are often reported according to the dimension they represent, the importance, expectation, and performance scores are shown by dimension in Tables 9 through 11. These dimensions correspond to tangibles, reliability, responsiveness, assurance, and empathy. The item numbers correspond to the items that compose each of these respective dimensions, according to Parasuraman, Zeithaml, and Berry (1994). The number of valid responses as well as the mean and standard deviation is shown for each dimension.

Table 9.

SERVQUAL Importance Ratings by Dimension

DIMENSION	N	MEAN	STD. DEVIATION
TANGIBLES	384	5.1206	1.0064
Q1	374	5.5722	1.4679
Q2	377	4.5119	1.4679
Q3	379	4.8997	1.5093
Q4	365	4.4877	1.5093
Q5	383	6.0548	1.0876
RELIABILITY	383	6.3171	.7050
Q6	375	6.5120	.7629
Q7	373	6.3968	.8153
Q8	378	6.3624	.8326
Q9	375	6.3627	.8121
Q10	361	5.9418	1.0617
RESPONSIVENESS	384	6.4497	.6903
Q11	382	6.3246	.8064
Q12	382	6.5916	.7141
Q13	378	6.4339	.7859
ASSURANCE	384	6.0909	.8673
Q14	380	6.2684	.9082
Q15	371	5.8760	1.1836
Q16	357	5.7675	1.2849
Q17	382	6.4084	.8170
EMPATHY	382	6.0218	.9122
Q18	379	6.0158	1.0363
Q19	368	6.1087	1.0795
Q20	376	5.8723	1.1887
Q21	377	6.0902	1.0275

The dimension rated highest in importance was responsiveness, with a mean of 6.45. The dimension rated lowest in importance was tangibles, with a mean of 5.12. It is evident from these results that having respondents rank dimensions by assigning numbers of points to the dimension overlooks the importance of individual items.

Table 10.

SERVQUAL Expectation Ratings by Dimension

DIMENSION	N	MEAN	STD.DEVIATION
TANGIBLES	380	5.7551	.9138
Q1	369	6.0813	1.1320
Q2	373	5.4209	1.3329
Q3	373	5.5442	1.3285
Q4	363	5.3554	1.3576
Q5	378	6.3386	.9078
RELIABILITY	379	6.4540	.6747
Q6	371	6.6011	.7070
Q7	369	6.5230	.7555
Q8	375	6.4693	.8001
Q9	371	6.4717	.7719
Q10	360	6.1972	.9456
RESPONSIVENESS	381	6.5652	.6463
Q11	378	6.4735	.7573
Q12	379	6.6728	.6371
Q13	374	6.5615	.7139
ASSURANCE	381	6.3327	.7498
Q14	377	6.4668	.8086
Q15	366	6.1749	1.0214
Q16	354	6.1243	1.0245
Q17	378	6.5450	.7530
EMPATHY	378	6.2687	.8118
Q18	375	6.2720	.8990
Q19	362	6.2956	.9639
Q20	371	6.1914	.9911
Q21	373	6.3244	.9125

The dimension rated highest in expectation was responsiveness, with a mean of 6.57. The dimension rated lowest in expectation was tangibles, with a mean of 5.76. Because the ratings of the individual expectation items were higher than importance ratings, each of the expectation dimensions reflected correspondingly higher ratings.

Table 11.

SERVQUAL Performance Ratings by Dimension

DIMENSION	N	MEAN	STD.DEVIATION
TANGIBLES	380	5.0675	1.0446
Q1	358	5.1453	1.2507
Q2	370	4.6000	1.4602
Q3	367	5.4114	1.2268
Q4	353	4.8045	1.3626
Q5	372	5.3360	1.2896
RELIABILITY	374	5.9467	.9369
Q6	365	6.0904	1.0613
Q7	358	5.9777	1.1150
Q8	367	6.0191	1.0093
Q9	363	5.9917	1.0603
Q10	341	5.5894	1.2278
RESPONSIVENESS	378	6.1578	.9651
Q11	373	5.9812	1.0985
Q12	376	6.3378	1.0147
Q13	371	6.1779	1.0632
ASSURANCE	379	5.9446	.8118
Q14	374	6.2567	1.0085
Q15	358	5.7765	1.1427
Q16	345	5.7913	1.1399
Q17	372	5.9624	1.0859
EMPATHY	376	5.9603	.9974
Q18	370	6.0757	1.0539
Q19	355	5.9549	1.1415
Q20	368	5.9674	1.0794
Q21	367	5.8447	1.1620

The dimension rated highest in performance was responsiveness, with a mean of 6.16. The dimension rated lowest in performance was tangibles, with a mean of 5.07. Because the ratings of the individual performance items were lower than either the importance or expectation ratings, each of the performance dimensions reflected correspondingly lower ratings.

The difference scores based on performance minus expectations and performance minus importance are shown by dimension in Tables 12 and 13. The number of valid responses as well as the mean and standard deviation is shown for each dimension.

Table 12.

SERVQUAL Performance Minus Expectation Scores

DIMENSION	N	MEAN	STD.DEVIATION
TANGIBLES	377	-.6769	1.0659
Q1	354	-.9379	1.3824
Q2	367	-.8256	1.6553
Q3	364	-.1291	1.4229
Q4	350	-.5457	1.5429
Q5	369	-1.0136	1.3742
RELIABILITY	371	-.5146	.8391
Q6	362	-.5166	1.0047
Q7	355	-.5493	1.0277
Q8	364	-.4478	.9506
Q9	360	-.4806	1.0012
Q10	338	-.6036	1.1541
RESPONSIVENESS	375	-.4080	.8634
Q11	370	-.4946	1.0128
Q12	373	-.3324	.9286
Q13	367	-.3842	1.0120
ASSURANCE	376	-.3985	.8663
Q14	371	-.2075	.9600
Q15	354	-.4266	1.0811
Q16	342	-.3363	.9631
Q17	368	-.5951	1.0858
EMPATHY	373	-.3126	.8902
Q18	367	-.2044	.9913
Q19	351	-.3590	1.0781
Q20	365	-.2219	.9708
Q21	364	-.4863	1.0743

Table 13.

SERVQUAL Performance Minus Importance Scores

DIMENSION	N	MEAN	STD.DEVIATION
TANGIBLES	380	-.0045	.9976
Q1	358	-.4497	1.4615
Q2	370	.0081	1.6293
Q3	367	.5068	1.3728
Q4	352	.3011	1.4773
Q5	372	-.7554	1.3365
RELIABILITY	374	-.3665	.8260
Q6	365	-.4274	.9880
Q7	358	-.4162	1.0221
Q8	367	-.3406	.9530
Q9	363	-.3719	.9900
Q10	338	-.3314	1.1490
RESPONSIVENESS	377	-.3006	.8882
Q11	372	-.3548	1.0294
Q12	375	-.2613	.9596
Q13	369	-.2683	1.0405
ASSURANCE	378	-.1658	.9411
Q14	373	-.0021	1.0393
Q15	356	-.1376	1.2106
Q16	344	.0058	1.1403
Q17	370	-.4784	1.1145
EMPATHY	375	-.0067	.9597
Q18	369	.0054	1.0541
Q19	353	-.2011	1.1613
Q20	367	.0087	1.1250
Q21	366	-.2678	1.1584

Importance of Dimensions by Assigned Points

Respondents were asked to rank the importance of each of SERVQUAL's 5 dimensions by assigning a total of 100 points among the dimensions. The reliability dimension was rated the highest, with a mean of 31.99. The tangibles dimension was rated the lowest, with a mean of 12.56. These ratings were similar to those found by

Nitecki (1995) in a survey of academic libraries. Nitecki reported a mean of 33.99 for the reliability dimension and a mean of 9.17 for the tangibles dimension. These findings reflect those reported in other SERVQUAL surveys that indicate reliability is the most important dimension and tangibles the least important dimension of service quality (Parasuraman, Zeithaml, and Berry, 1994). Ratings for the 5 dimensions are shown in Table 14.

Table 14.

Importance Ratings of SERVQUAL's 5 Dimensions

Descriptive Statistics

	N	Mean	Std. Deviation
RELPTS	378	31.9987	14.8970
RESPPTS	378	22.2884	8.4016
ASSPTS	377	17.8846	7.5255
EMPPTS	376	15.4574	8.9080
TANPTS	375	12.5600	7.4734
Valid N (listwise)	374		

Library Success Scores

Importance ratings of the library success items are shown in Table 15. Average importance rating of the items on the library success instrument was 6.02, slightly higher than the average importance ratings on SERVQUAL. This is very close to the average importance rating of 6.05 reported by Magal (1991) in a survey of information center users with a similar instrument.

Table 15.

Library Success Importance Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
ACCUI	375	6.4800	.7557
RELIABLI	367	6.4796	.7604
COMPLETI	370	6.3811	.8285
CURRENTI	366	6.3770	.7938
COOPI	379	6.3272	.8411
COMPI	372	6.3199	.8125
PRECISEI	354	6.3051	.8698
FASTI	376	6.2952	.7801
RELEVI	367	6.2834	.8566
ACCESSI	292	6.1438	.8967
RELNEEDI	363	6.0744	.9620
COMMI	375	6.0507	.9757
RELATESI	380	5.9211	1.0843
INDEPI	374	5.6979	1.3311
HOWTOI	375	5.6587	1.2392
CONTROLI	360	5.2778	1.4647
TRAINI	367	5.2643	1.3961
PARITICI	360	4.9694	1.5175
Valid N (listwise)	229		

Mean ratings ranged from a high of 6.48 to a low of 4.97. Four of the 5 items rated highest in importance pertained to the quality of information dimension. Items rated lowest in importance related to user self-sufficiency. In the survey by Magal (1991), items rated the highest in importance pertained primarily to staff services, although two items from the user developed applications dimension were also rated high. Items pertaining to user self-sufficiency were also rated the lowest in importance in Magal's survey.

Table 16.

Library Success Performance Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
COOPP	374	6.2059	.9948
ACCUP	366	6.1721	.9188
RELIABLP	358	6.1425	.9523
RELATESP	368	6.0516	1.0041
PRECISEP	340	6.0029	1.0461
COMPP	361	5.9889	1.0540
COMMP	371	5.9057	1.0726
COMPLETP	359	5.8997	1.0172
RELEVP	359	5.8942	1.0329
ACCESSP	287	5.8432	1.1647
CURRENTP	352	5.7983	1.1799
FASTP	368	5.7880	1.2391
RELNEEDP	355	5.5887	1.2622
HOWTOP	367	5.4986	1.2121
INDEPP	362	5.4171	1.3398
PARTICIP	349	5.2120	1.4407
CONTROLP	348	5.1983	1.3930
TRAINP	351	5.0171	1.4019
Valid N (listwise)	200		

Performance ratings of the library success items are shown in Table 16. Average performance rating of the items on the library success instrument was 5.76, which is slightly higher than the average performance rating of 5.54 reported by Magal (1991). The item rated highest pertained to the cooperative attitude of the library staff. Other performance items rated high pertained to information quality. Performance items rated lowest pertained to user-self sufficiency. These performance rankings were similar to those found by Magal.

Average importance rating of the system quality items on the library success instrument was 5.76, and average performance rating of the system quality items was 5.27. The items pertaining to system quality were rated less important than items pertaining to information quality and staff service quality, and more important than items related to user self-sufficiency. The system quality item rated most important to respondents was the ability to interact with an online catalog in a clear and understandable way. The fewer system quality performance ratings reflect the lack of experience with a local online library catalog at the Little Rock District site. The system quality ratings are shown in Table 17.

Table 17.

Library System Quality Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
OPCLEARI	342	6.0088	1.1551
OPLEARNI	347	5.9798	1.2007
OPUSEI	351	5.9715	1.2326
OPSKILLI	343	5.9067	1.2507
OPLEARNP	246	5.3252	1.4142
OPUSEP	250	5.3240	1.4350
OPCLEARP	240	5.2208	1.4853
OPSKILLP	239	5.2050	1.4709
Valid N (listwise)	230		

The average rating for library usefulness was 5.39. There was a significant difference ($p = .005$) between the average library usefulness rating at Vicksburg (5.48)

and Little Rock (5.08). There were no significant differences between ratings of overall usefulness of the libraries, nor between ratings of the libraries in regard to making it possible for users to accomplish tasks faster and more effectively. The Vicksburg library was rated higher than the Little Rock library in the ability to make it easier for users to do research, to be more productive, and improve users' ability to do research. The larger facility, the larger collection size, and the larger number of library staff at Vicksburg may explain some of these differences.

There were no significant differences in the average library usefulness rating between male or female respondents, between respondents below 45 years of age and above 45 years of age, or between engineers and respondents from other job categories. Library usefulness ratings are shown in Table 18.

Table 18.

Library Usefulness Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
USEFUL	382	5.7775	1.2168
EASIER	375	5.4907	1.3281
IMPROVES	374	5.4332	1.3401
ENHANCES	381	5.2913	1.2760
ENABLES	380	5.2026	1.3270
FASTER	380	5.0974	1.2743
Valid N (listwise)	373		

The average library involvement rating was 5.37. The item rated highest in involvement pertained to the importance of the library to the respondent. The item rated lowest in involvement pertained to how fascinating the library was to the respondent. There was a significant difference (p = .029) between library involvement at Vicksburg (5.45) and Little Rock (5.14). Respondents at Vicksburg were slightly more involved with the library. This difference may be due to the greater pressure to publish technical articles and reports at Vicksburg than at the Little Rock site. Researchers at Vicksburg may feel more dependent on the library to assist research in the publication process. There was no significant difference in involvement between respondents less than 45 years of age and greater than 45 years of age, or between engineers and respondents in other job categories. There was a significant difference (p = .010) in involvement between male (5.30) and female (5.64) respondents. Females were more involved with the library than males. Library involvement ratings are shown in Table 19.

Table 19.

Library Involvement Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
IMPORTANT	375	6.0080	1.2697
FUNDAME	368	5.8098	1.3438
RELEVANT	373	5.4799	1.7606
INTEREST	371	5.1887	1.5235
APPEAL	373	5.0027	1.4982
FACINATE	370	4.7459	1.3416
Valid N (listwise)	363		

Two items were used to measure behavioral intentions. These related to the likelihood of library users to use the library in the future and to recommend others to use the library. Library behavioral intention item ratings are shown in Table 20.

Table 20.

Library Behavioral Intention Ratings

Descriptive Statistics

	N	Mean	Std. Deviation
RECOMM	383	6.1723	1.2518
FUTURE	384	6.1354	1.4853
Valid N (listwise)	382		

There was no significant difference between the Vicksburg and Little Rock sites in either likelihood of future use or recommending the library to others. There was also no significant difference between gender, age, or job category in the likelihood of recommending the library to others. However, there was a significant difference between gender ($p = .008$), age ($p = .042$), and job category ($p = .006$) in the likelihood of future use of the library. Men were more likely to use the library in the future. Respondents below the age of 45 were more likely to use the library in the future, and engineers and scientists were more likely to use the library in the future than other job categories. There was no significant difference between engineers and scientists in the likelihood of future use of the library.

None of these results are surprising. Men engineers and scientists make up the predominant research group within the U.S. Army Corps of Engineers, so they would be the most likely to use the library in the future. Respondents below the age of 45 may have been exposed to more library use in their education. Younger engineers and scientists are also probably doing more research for publishing in order to be more competitive in the job market.

Table 21.

Overall Ratings of Library Service Quality, Satisfaction, and Value

Descriptive Statistics

	N	Mean	Std. Deviation
SERVICE	385	6.0416	1.1008
SERVSAT	383	5.8616	1.1886
LIBSAT	385	5.7662	1.3159
VALUE	378	5.6587	1.2937
AVLIBSAT	385	5.6554	1.1784
Valid N (listwise)	376		

Overall library service quality, library value, and 3 different types of library satisfaction measures are shown in Table 21. Three measures of library satisfaction were tested in order to see how they compared to an overall measure of library service quality and library value. One measure pertained to overall satisfaction with library service (SERVSAT). A second measure pertained to overall satisfaction with the library (LIBSAT). A third measure consisted of 4 items averaged together to reflect a measure of library satisfaction (AVLIBSAT). These 4 items, which were the same ones used by

Seddon and Kiew (1994) to measure information system satisfaction, pertained to customer perceptions of library effectiveness, efficiency, adequacy, and satisfaction.

There was a significant difference ($p = .000$) between the means of the 3 library satisfaction measures and the mean library service quality score (SERVICE). Library service quality (SERVICE) was the highest rated, with a mean of 6.04. The library satisfaction measure composed of an average of 4 items (AVLIBSAT) was the lowest rated, with a mean of 5.65.

There was no significant difference in ratings of library value, overall library service quality, or overall library satisfaction between respondents at the Vicksburg and Little Rock sites. There was also no significant difference in ratings of library value, overall library service quality, or overall library satisfaction between engineers and respondents in other job categories, or between respondents below 45 years of age and above 45 years of age.

There was a significant difference ($p = .003$) in overall library satisfaction rating between genders, and also a significant difference ($p = .01$) in overall library service quality rating between genders. Females rated overall library service quality and overall library satisfaction higher than males. There was no significant difference in ratings of library value between genders.

There is no clear explanation for the difference in overall library satisfaction and service quality ratings between genders. Nitecki (1995) also reported finding a difference in service quality perceptions between men and women, but did not offer an explanation. Of the women respondents in this survey, 33% had administrative jobs, and 45% were engineers or scientists. This compares to 82% of the men respondents who were

engineers or scientists. It may be that women administrative workers place less demands on the library and are more likely to be satisfied than engineers and scientists who have greater research requirements and needs. However, since there was no significant difference in overall library satisfaction or service quality ratings found between engineers and other job types, occupation does not appear to be the primary reason for the difference in overall library satisfaction and service quality ratings between genders.

CHAPTER 5

DATA ANALYSIS

Reliability and Validity of the Library Service Quality Instrument

The first hypothesis states that performance scores exhibit higher reliability and validity, and explain more variation in library service quality than difference scores, performance minus expectations (p-e). Reliability was tested first with Cronbach's alpha in order to compare results with previous SERVQUAL surveys. The findings were consistent with previous SERVQUAL surveys, in that performance scores have been found to exhibit higher reliability and validity than difference scores. Alpha scores of both performance and difference scores are shown in Table 22.

Table 22.

Reliability of Performance and Difference Scores

Dimension	Cronbach's Alpha (Performance)	Cronbach's Alpha (Difference)	John's Alpha (Difference)
Tangibles	0.84	0.78	0.70
Reliability	0.91	0.88	0.82
Responsiveness	0.88	0.84	0.81
Assurance	0.87	0.84	0.72
Empathy	0.92	0.87	0.84

All of the performance scores exceeded the 0.80 recommended alpha value (Nunnally, 1978). The alpha for the performance scores ranged from a low of 0.84 for the

tangibles dimension to a high of 0.92 for the empathy dimension. The alpha for the difference scores ranged from a low of 0.78 for the tangibles dimension to a high of 0.88 for the reliability dimension. These results compare to alpha scores reported by Nitecki (1995) in a survey of academic library users that ranged from 0.69 for tangibles to 0.86 for reliability.

However, it has been pointed out that Cronbach's alpha is inappropriate when using difference scores and should be replaced by John's alpha for calculating reliability of difference scores (Van Dyke, Kappelman, & Prybutok, 1997). John's alpha resulted in lower alpha scores, and 2 dimensions dropped below the recommended 0.80.

Higher correlations were found between performance scores and an overall rating of library service quality than between difference scores (p-e) and an overall rating of library service quality. Correlations for each dimension ranged from a low of 0.504 to a high of 0.638 for performance and from 0.341 to 0.572 for difference scores (p-e). These findings reflect those found by Nitecki (1995) in a survey of academic library users. Nitecki found correlations ranging from 0.440 to 0.781 for performance scores and 0.262 to 0.683 for difference (p-e) scores.

All the performance scores in this study showed a higher correlation with library service quality than difference scores. The lowest correlation between performance scores and library service quality was 0.33, and 14 out of 21 items had correlations greater than 0.50. The lowest correlations were with items from the tangibles dimension, and if these items are excluded, 14 out of 16 items had correlations greater than 0.50.

The lowest correlation between difference scores (p-e) and library service quality was 0.19, and only 2 out of 21 items had correlations greater than 0.50. Correlations

between library service quality and performance and difference scores by dimension are shown in Table 23.

Table 23.

Correlations Between SERVQUAL Scores and Library Service Quality

Dimension	Difference Scores	Performance Scores
Tangibles	0.341	0.504
Reliability	0.557	0.627
Responsiveness	0.520	0.570
Assurance	0.572	0.638
Empathy	0.544	0.604

Convergent validity of SERVQUAL was checked by measuring the extent each item correlated with items in the same factor or dimension. For the performance scores, all correlations were significant at the alpha = 0.01 level. Correlations among the tangibles dimension ranged from 0.41 to 0.68 with 8 of 20 items correlating above 0.50. All correlations among the reliability dimension were higher than 0.51, with correlations ranging from 0.51 to 0.78. All correlations among the responsiveness dimension were higher than 0.65, with correlations ranging from 0.65 to 0.82. All correlations among the assurance dimension were higher than 0.54, with correlations ranging from 0.54 to 0.74. All correlations among the empathy dimension were higher than 0.69, with correlations ranging from 0.69 to 0.80.

For the difference scores, correlations among the tangibles dimension ranged from 0.13 to 0.64. Five out of 20 items in the tangibles dimension had correlations above

0.50. One item from the tangibles dimension, hours, had a correlation significant at the alpha = 0.05 level. All other items in the tangibles dimension had correlations significant at the alpha = 0.01 level. Correlations for items in the reliability dimension ranged from 0.44 to 0.73, with 16 out of 20 items having a correlation higher than 0.50. All were significant at the alpha = 0.01 level. Correlations for items in the responsiveness dimension ranged from 0.57 to 0.75. All were significant at the alpha = 0.01 level. Correlations for items in the assurance dimension ranged from 0.49 to 0.72. All were significant at the alpha = 0.01 level. Correlations for items in the empathy dimension ranged from 0.58 to 0.67. All were significant at the alpha = 0.01 level. These results suggest that both performance and difference scores exhibit convergent validity, although performance scores exhibit slightly higher convergence than difference scores.

Discriminant validity was checked by counting how many times an item had a higher correlation with an item from another dimension than with items in its own dimension. Campbell and Fiske (1959) have suggested that a count of less than half the potential comparisons is generally acceptable, or less than 50%.

For the performance scores, out of 348 comparisons, there were 124 cases where the correlation was higher outside the dimension being examined, or 36%. This compares to a count of 134 out of 348 comparisons, or 39% for the difference (p-e) scores. These results indicate that both performance and difference scores have discriminant validity, although performance scores exhibit slightly higher discrimination than difference scores.

Item-total correlations for the performance scores ranged from 0.50 to 0.83, with 19 of 21 items greater than 0.60. Item-total correlations for the difference scores (p-e) ranged from 0.44 to 0.77, with 16 of 21 items greater than 0.60. These correlations are all

higher than the recommended 0.35 cutoff (Saxe & Weitz, 1982). Together with the higher correlations with library service quality, these results suggest that the performance scores possess greater internal consistency and content validity.

A regression analysis was performed to check the ability of performance and difference scores to predict library service quality. When library service quality was used as the dependent variable, performance scores had an adjusted R^2 value of 0.48 compared to an adjusted R^2 of 0.40 for difference scores (p-e).

These findings are consistent with results from a number of previous studies, and indicate that performance scores alone predict service quality better than difference scores (p-e). The results support hypothesis 1 and indicate that performance scores exhibit higher reliability and validity, and explain more variance in library service quality than difference scores.

Expectation versus Importance Scores

The second hypothesis states that performance minus importance scores exhibit higher reliability and validity, and explain more variation in library service quality than performance minus expectation scores. This survey found a significant difference ($p < .001$) between mean importance (5.95) and expectation (6.25) ratings. Importance was rated lower than expectations for every item. Standard deviations for importance ratings were also higher than expectations for every item. These findings are similar to those reported by Smith (1995) in a survey of hospital service quality. Smith found that in most cases importance was rated lower and exhibited a higher standard deviation than expectations. This suggests that asking respondents to rate expectations is different from

asking respondents to rate importance of items, and that in general, respondents will rate expectations higher than importance.

Although importance scores were rated generally lower and exhibited less variance restriction, performance minus importance scores exhibited slightly less reliability than performance minus expectation scores in each dimension. Cronbach's alpha is shown for both performance minus expectation and performance minus importance scores in Table 24.

Table 24.

Reliability of Importance and Expectation Scores

Dimension	Cronbach's Alpha Performance-Expectations	Cronbach's Alpha Performance-Importance
Tangibles	0.78	0.69
Reliability	0.88	0.86
Responsiveness	0.84	0.83
Assurance	0.84	0.81
Empathy	0.87	0.85

Performance minus importance scores exhibited higher variance except in the tangibles and reliability dimensions, and similar correlations within dimensions as performance minus expectations. Performance minus importance scores correlated with library service quality slightly lower than performance minus expectation scores in each dimension except in the tangibles and responsiveness dimensions. When library service quality was used as the dependent variable in a regression analysis, performance minus

importance scores had an adjusted R^2 value of 0.43 compared to an adjusted R^2 of 0.40 for performance minus expectation scores.

These results show partial support for hypothesis 2. It appears that the use of performance minus importance scores does not appear to be significantly better or worse than performance minus expectations. Performance minus expectation scores appear slightly more reliable, but performance minus importance scores appear to predict library service quality slightly better than expectation scores. Neither type of difference score appears to show stronger validity. At the same time, expectation and importance are different constructs, and researchers should be careful to insure they are not measuring importance when they are attempting to measure expectations.

Importance of Dimensions versus Importance of Items

Hypothesis 3 states that the relative importance of service quality dimensions obtained by allocation of points to dimensions differs from those obtained by ratings of the importance of individual items. Results of this survey indicate that when respondents were asked to rate the importance of each item, the mean rating for the responsiveness

Table 25.

Comparison of Importance Ratings

Dimension	Mean Points Assigned	Mean Item Score
Tangibles	12.56	5.12
Reliability	31.99	6.32
Responsiveness	22.29	6.45
Assurance	17.88	6.09
Empathy	15.46	6.02

dimension (6.45) was higher than the mean rating for the reliability dimension (6.32). When respondents were asked to assign points to each dimension, the mean rating for the reliability dimension was 31.99 and the mean rating for the responsiveness dimension was 22.29.

However, the general ranking for all the dimensions was similar when respondents were asked to rate the dimensions and the individual items. Tangibles and empathy were considered least important, and reliability and responsiveness were considered the most important. Mean ratings of both the importance of the dimension and the importance of individual items by dimension are shown in Table 25.

The item rated highest in importance pertained to responsiveness rather than reliability. Only 2 of the 5 items rated highest in importance pertained to reliability; 2 related to responsiveness, and one related to assurance. These results indicate either some confusion between the items pertaining to reliability and responsiveness, or that asking respondents to rate each dimension differs from asking respondents to rate the importance of individual items pertaining to each dimension. At the same time, it appears that if respondents are asked to rate the importance of individual items, it is not necessary to ask them to also rate the importance of the dimensions, since the overall ranking of the dimensions is relatively the same.

However, rating only the importance of the dimensions fails to identify which items within these dimensions are most important to customers. For example, in this study, one item related to reliability was rated low, while one item related to assurance was rated high. If managers target what services to emphasize based on ratings of dimensions alone, they could fail to emphasize some items that customers consider

important, and emphasize other items that customers consider less important. Measuring the importance of individual items may be especially critical when comparing customer preferences to service performance levels.

Library Service Quality versus Library Satisfaction

Hypothesis 4 states that performance minus expectation scores explain more variation in library service quality than library satisfaction when expectations are described as what an excellent library "should" deliver, and performance minus importance scores also predict library service quality better than library satisfaction. A regression analysis was performed on both the performance minus expectation and performance minus importance scores, first with library service quality as the dependent variable, and then with library satisfaction as the dependent variable.

Performance minus expectation scores predicted library service quality (adjusted $R^2 = 0.40$) slightly better than library satisfaction (adjusted $R^2 = 0.39$), but performance minus importance scores predicted library satisfaction (adjusted $R^2 = 0.44$) slightly better than library service quality (adjusted $R^2 = 0.43$). Parasuraman, Zeithaml, and Berry (1988) stated that when expectations are described as what an excellent firm "should" offer, they are measuring service quality, and when expectations are described as what an excellent firm "would" offer, they are measuring customer satisfaction (p. 17). The results of this survey tend to support the theory that expectations described as what a library "should" deliver are measuring service quality as opposed to library satisfaction. Rating importance, however, appears to be measuring a different construct, one that may be more related to satisfaction than service quality.

These results suggest that the difference between performance and expectations may be more closely related to service quality than the difference between performance and importance. At the same time, performance scores alone predicted service quality slightly better (adjusted $R^2 = 0.48$) than library satisfaction (adjusted $R^2 = 0.44$) and also predicted service quality better than either performance minus expectations or performance minus importance. This finding suggests that it may be better to use performance scores alone to measure service quality.

A separate regression was performed on the difference scores and performance scores using library value as the dependent variable. Service value is considered a different construct than service quality or customer satisfaction (Zeithaml, 1988), and the results of this study tend to support this belief. SERVQUAL did not predict value as well as service quality or customer satisfaction, which should be the case if SERVQUAL is designed to measure service quality rather than value. The adjusted R^2 values for the performance minus expectation, performance minus importance, and performance scores alone with different summary measures as dependent variables are shown in Table 26.

Table 26.

Adjusted R^2 Values of Summary Measures

Dependent Variable	P-E Scores	P-I Scores	Performance Scores
Value of Library Service	0.32	0.31	0.40
Overall Library Satisfaction	0.39	0.44	0.44
Library Service Quality	0.40	0.43	0.48
Library Service Satisfaction	0.42	0.44	0.48
Average* of Library Satisfaction	0.41	0.42	0.52

* Score based on average of adequacy of meeting information needs, efficiency, effectiveness, and library satisfaction

When variations of library satisfaction and library service are used as the dependent variable, wording of the overall summary statement should be carefully considered. In this study, for example, respondents were asked to rate both service quality and satisfaction with service. From the results, performance scores predict both service quality and satisfaction with service equally well, suggesting both service quality and service satisfaction are measuring similar constructs. However, performance scores predicted library satisfaction based on an average of 4 items better than either service quality measure.

At the same time, it is not clear whether these 4 items are more related to service quality than to satisfaction, since it asks respondents to rate adequacy, effectiveness, and efficiency in addition to satisfaction. Although Seddon and Kiew (1994) used these 4 items to measure satisfaction levels with an information system, adequacy of meeting information needs, efficiency, and effectiveness could just as easily apply to service quality. Until the differences are clarified, researchers should ask respondents to rate both overall service and overall satisfaction in order to be able to compare results with other SERVQUAL surveys.

Number of SERVQUAL Dimensions

Hypothesis 5 states that the number of SERVQUAL dimensions varies when library service quality is calculated using performance or expectation scores rather than difference scores. It also states that library service quality exhibits either a 3 or 5-dimensional structure similar to that found by Parasuraman, Zeithaml, and Berry in 1994.

In order to determine if different dimensional structures are found when using different types of service quality scores, a factor analysis was performed on each type of

score. First, an unconstrained principal components factor analysis was performed on the performance scores. The factor analysis extracted 3 factors with eigenvalues greater than one. The initial eigenvalues and a summary of the variance explained by the performance scores are shown in Table 27.

Table 27.

Components Extracted Using Performance Scores

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	12.481	59.432	59.432	6.834	32.544	32.544
2	1.584	7.543	66.975	4.973	23.679	56.223
3	1.006	4.789	71.764	3.264	15.541	71.764
4	.722	3.439	75.203			
5	.631	3.006	78.209			
6	.534	2.542	80.752			
7	.522	2.486	83.238			
8	.450	2.143	85.381			
9	.412	1.964	87.345			
10	.365	1.739	89.084			
11	.341	1.623	90.706			
12	.301	1.435	92.141			
13	.280	1.332	93.474			
14	.254	1.211	94.684			
15	.231	1.099	95.783			
16	.203	.968	96.750			
17	.180	.858	97.609			
18	.164	.780	98.389			
19	.125	.598	98.987			
20	.114	.541	99.527			
21	9.923E-02	.473	100.000			

Extraction Method: Principal Component Analysis.

A varimax rotation was performed on the performance scores. After the rotation was performed, the items pertaining to responsiveness, assurance, and empathy tended to load onto the same dimension, while items pertaining to tangibles and reliability loaded as separate dimensions. A summary of the rotated components with loadings greater than 0.50 is shown in Table 28.

Table 28.

Rotated Component Matrix of Performance Scores

Rotated Component Matrix[a]

	Component		
	1	2	3
MODERNP			.695
FACILITP			.873
NEATP			.530
SIGNSP			.796
HOURSP		.533	.519
PROMISEP		.687	
DEPENDP		.695	
FRSTIMEP		.784	
ATTIMEP		.808	
INFORMP		.522	
PROMPTP		.739	
WILLINGP	.712		
READYP	.698	.504	
COURTP	.750		
CONFP	.695		
SAFEP	.661		
KNOWP	.649		
ATTENTP	.792		
INTRSTP	.765		
CAREP	.800		
NEEDSP	.735		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

A separate factor analysis was performed on just the expectation scores. A principal components factor analysis of the expectation scores extracted 3 factors with eigenvalues greater than one. A summary of the variance explained and initial eigenvalues is shown in Table 29.

Table 29.

Components Extracted Using Expectation Scores

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.409	54.328	54.328	6.486	30.886	30.886
2	1.892	9.010	63.338	5.120	24.379	55.265
3	1.203	5.729	69.067	2.898	13.802	69.067
4	.876	4.172	73.239			
5	.711	3.385	76.624			
6	.586	2.791	79.415			
7	.551	2.624	82.039			
8	.428	2.036	84.075			
9	.401	1.909	85.984			
10	.360	1.714	87.698			
11	.347	1.653	89.351			
12	.317	1.508	90.859			
13	.309	1.470	92.329			
14	.276	1.316	93.645			
15	.245	1.166	94.811			
16	.230	1.093	95.905			
17	.212	1.007	96.912			
18	.178	.849	97.761			
19	.173	.822	98.583			
20	.155	.737	99.320			
21	.143	.680	100.000			

Extraction Method: Principal Component Analysis.

A varimax rotation on the expectation scores indicated that the items pertaining to the reliability and responsiveness dimensions tended to load together, as did items pertaining to assurance and empathy, while 3 items pertaining to tangibles loaded separately. A summary of the rotated components with loadings greater than 0.40 is shown in Table 30.

Table 30.

Rotated Matrix of Expectation Scores

Rotated Component Matrix[a]

	Component		
	1	2	3
MODERNE	.446		
FACILITE			.822
NEATE			.874
SIGNSE			.854
HOURSE	.555		
PROMISEE	.825		
DEPENDE	.779		
FRSTIMEE	.795		
ATTIMEE	.759		
INFORME	.591	.404	
PROMPTE	.785	.406	
WILLINGE	.809		
READYE	.717	.459	
COURTE	.492	.533	
CONFE		.712	
SAFEE		.758	
KNOWE	.545	.591	
ATTENTE	.442	.674	
INTRSTE		.776	
CAREE		.774	
NEEDSE	.440	.708	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

A separate factor analysis was performed on the difference scores (p-e). A principal components factor analysis of the difference scores (p-e) extracted 4 factors with eigenvalues greater than one. A summary of the variance explained and initial eigenvalues is shown in Table 31.

Table 31.

Components Extracted Using Difference Scores

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.500	50.000	50.000	5.949	28.327	28.327
2	2.019	9.615	59.615	4.522	21.531	49.858
3	1.163	5.539	65.154	2.252	10.723	60.581
4	1.123	5.349	70.503	2.084	9.922	70.503
5	.697	3.321	73.823			
6	.673	3.207	77.030			
7	.621	2.959	79.989			
8	.530	2.523	82.512			
9	.510	2.430	84.941			
10	.402	1.915	86.856			
11	.384	1.827	88.683			
12	.345	1.642	90.325			
13	.318	1.517	91.841			
14	.292	1.392	93.233			
15	.272	1.294	94.527			
16	.245	1.167	95.694			
17	.221	1.051	96.745			
18	.212	1.011	97.756			
19	.170	.811	98.567			
20	.162	.773	99.340			
21	.139	.660	100.000			

Extraction Method: Principal Component Analysis.

A varimax rotation on the difference scores indicated that responsiveness, assurance, and empathy, formed a single dimension, similar to that found when using performance scores. Reliability was a separate dimension, while tangibles split into two dimensions. A summary of the rotated components with loadings greater than 0.50 is shown in Table 32.

Table 32.

Rotated Component Matrix of Difference Scores.

Rotated Component Matrix[a]

	Component			
	1	2	3	4
MODPE				.713
FACILPE			.700	.517
NEATPE			.839	
SIGNSPE			.829	
HOURSPE				.786
PROMSPE		.670		
DEPENPE		.692		
FRSTIMPE		.746		
ATTIMEPE		.784		
INFORMPE		.666		
PROMPPE		.740		
WILLPE	.667			
READYPE	.671			
COURTPE	.728			
CONFPE	.714			
SAFEPE	.713			
KNOWPE	.633			
ATTENTPE	.744			
INTRSTPE	.756			
CAREPE	.774			
NEEDPE	.705			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

These results suggest that different dimensional structures may be found when different types of scores are used. SERVQUAL researchers should analyze and report the results of each type of score, especially when using performance and difference scores. These results also suggest that the best model of SERVQUAL appears to be a 3-factor model consisting of tangibles, reliability, and a single factor composed of items from responsiveness, assurance, and empathy. Parasuraman, Zeithaml, and Berry found evidence of a 3-dimensional model of service quality in 1994, and these results suggest support for a 3-dimensional model in regard to library service quality.

These 3 dimensions might be better represented in libraries as service environment, service performance quality, and quality of service delivery. Items pertaining to the tangibles dimension could be considered related to the overall service environment. Some service quality studies have indicated that the tangibles dimension is relatively unimportant to most customers and should be discarded (Kettinger & Lee, 1997). However, Maddox-Swan (1998) found evidence that the tangibles dimension may be more important to academic library users than to customers in other SERVQUAL surveys. Part of the problem may be due to the way items pertaining to the tangibles dimension are currently worded in SERVQUAL. For example, the size and relevance of a library collection may be considered more important to library customers than neatly dressed staff members. Further evidence of the need to re-write the items pertaining to the tangibles dimension was found in this study. Although the tangibles dimension was rated low in importance, a number of customers commented that the condition of the lighting, the copy machine, and the collection were important to them. Items pertaining to reliability may be related to quality of service performance. These items reflect how well

the service itself is performed. Is it done right the first time, or when promised? This dimension may be related to the service product, especially in regard to libraries, since information can be considered both a service and a product (Goldhar, 1979). Evidence that information quality may be related to library service quality was found in this study, suggesting it may be important to measure aspects of information quality when measuring service quality. Items pertaining to responsiveness, assurance, and empathy may be related to the manner in which service is delivered. Some library reference studies indicate that library customers make a distinction between how accurately their questions are answered and how polite the library staff is to the customer (Murfin & Gugelchuk, 1987). Items pertaining to courtesy, personal attention, and responsiveness might all be grouped under a single dimension related to manner of service delivery.

Differences in Perceptions of Library Service Quality

Hypothesis 6 states that perceptions of library service quality differ by gender, occupation, and amount of reliance on library staff, but do not differ by age or frequency of use. Independent samples t-tests indicated a significant difference ($p=0.018$) in mean performance ratings of library service quality between men (5.71) and women (5.95). Women tended to rate library service quality higher. Respondents who said they relied upon library staff frequently or higher when using the library were considered to rely on library staff frequently. T-tests indicated a significant difference ($p<0.001$) in mean performance ratings of library service quality between users who rely frequently on library staff (5.85) and users who do not rely frequently on library staff (5.40). Users who relied more on library staff tended to rate library service quality higher. Respondents who said they had used or requested service from the library at least 6 to 10 times were

considered frequent users. T-tests indicated a significant difference ($p=0.013$) in mean performance ratings of library service quality between frequent library users (5.78) and infrequent library users (5.67). Frequent library users tended to rate library service quality higher. However, t-tests indicated no significant difference between age groups in mean performance ratings of library service quality. There was also no significant difference between engineers and scientists and other occupations in mean performance ratings of library service quality. These results show partial support for hypothesis 6. Perceptions of library service quality do appear to differ by gender and amount of reliance on library staff, but not by occupation. At the same time, perceptions of library service quality do not appear to differ by age, but they do appear to differ by frequency of library use.

Service Quality and Behavioral Intentions

Hypothesis 7 states that library users who perceive library service as useful or valuable rate library service quality higher, and that library users who rate library service quality high are more likely to use the library in the future or recommend the service to others. Library users were separated into two groups for analysis. Respondents who had an average usefulness score of 5 or higher on a scale of 1 to 7 were considered to rate the library high in usefulness. Those who rated library value as 5 or higher on a scale of 1 to 7 were considered to rate the library high in value. T-tests indicated a significant difference ($p<0.001$) in library service performance ratings between users who rated library service high in value (5.95) and users who rated the library service low in value (4.92). Users who rated the library high in value tended to rate library service performance higher. T-tests also indicated a significant difference ($p<0.001$) in library service performance ratings between those who rated the library high in usefulness (6.06)

and those who rated the library low in usefulness (5.07). Respondents who rated the library highly useful tended to rate library service performance higher.

Library users indicated on a scale of 1 to 7 how likely they were to use the library in the future or to recommend others to use the library. Such measures have been used to examine the impact of service quality on users' behavioral intentions (Parasuraman, Zeithaml, and Berry, 1994). Theoretically, a user who rates a company high in service is more likely to continue to use that company or to recommend that others use the company than a user who rates a company low in service. To examine the association between library service quality and behavioral intentions, the score for each question pertaining to behavioral intentions was correlated with the mean service performance rating. A significant ($p=0.01$), but weak, correlation (0.269) was found between library service performance rating and the likelihood a user will use the library in the future. A stronger correlation (0.426) was found between library service performance rating and the likelihood a user will recommend the library service to others. One explanation for the weaker correlation found in this study between service quality rating and future library use may be partially due to the unavailability of choices for these library users. There is only one library facility at these research sites, and there is no other library within the immediate area that can provide the type of reports and documents that are unique to the research being conducted at these sites. Library users at these sites may be prone to continue using the library regardless of the quality of service performance encountered. When use is not optional, usefulness may be a better indicator of satisfaction than frequency of use (Seddon & Kiew, 1994). The same may be true for the tendency for users to use the library in the future. If there are limited choices, the degree

of future use may not be closely related to library service quality. If this were the case, one might expect a higher correlation between library service quality and usefulness than between library service quality and future use, or between library service quality and frequency of use.

Results indicate support for hypothesis 7. Library users who perceive library service as useful or valuable tend to rate library service quality higher, and library users who rate library service quality high are more likely to use the library in the future or recommend the service to a friend. These results also suggest that the degree of library usefulness may be a better indication of library service quality than either future use or frequency of use.

SERVQUAL and Library Success Instrument Compared

Hypothesis 8 states that a library success instrument and SERVQUAL together predict library user satisfaction better than a library success instrument alone, and both instruments predict library service quality better than SERVQUAL alone. The library success instrument includes an instrument developed by Magal (1991) to measure information center success. Magal's instrument consisted of almost the same items used by Kettinger and Lee (1994) to measure satisfaction with a campus information system. Kettinger and Lee's instrument consisted basically of a modified version of the Ives, Olson, and Baroudi (1983) instrument used to measure information system satisfaction. The difference between Magal's instrument and Kettinger and Lee's is that Magal added two questions pertaining to quality of service and two questions pertaining to user self-sufficiency. Magal also excluded a question pertaining to the time required for new systems development because it did not appear to be applicable, and Kettinger and Lee

eliminated the same question after performing a second-order confirmatory factor analysis. Kettinger and Lee also used a semantic differential scale, whereas Magal had respondents rate items on importance and performance using a 7-point scale ranging from low to high. Since Magal's scale was closer to the SERVQUAL scale adopted by Parasuraman, Zeithaml, and Berry in 1994, this survey utilized the same 7-point scale ranging from low to high on both instruments to maintain scale consistency.

A second-order confirmatory factor analysis was performed on SERVQUAL and the library success instrument with AMOS. AMOS is a more graphical approach to structural equation modeling than LISREL (Joreskog & Sorbom, 1993), although the modeling procedure is similar. AMOS is also capable of using SPSS files directly without the necessity of converting the data to a correlation matrix. However, in order to check results, an analysis was also performed on SERVQUAL with LISREL 8, using the SIMPLIS command language.

Following the procedure used by Kettinger and Lee (1994), a confirmatory factor analysis was first performed on the difference scores (p-e) of 21 items that make up the SERVQUAL instrument. Parameters were estimated using the maximum likelihood (ML) method. In order to find a proper level of model fit, squared multiple correlations (SMCs) were examined, along with standardized residuals, and t-values. These were the same parameters used by Kettinger and Lee (1994) to fit their model. SMCs were considered to delineate the strength between an indicator and a variable, and considered low if they were below 0.50. Standardized residuals were interpreted as standard normal deviates and considered large if they exceeded 2.58 in absolute value. Items that exhibited low SMC,

high standardized residuals, or low t-values were examined for possible elimination from the model.

Initially, 5 items exhibited an SMC lower than the 0.50 cutoff used by Kettinger and Lee (1994). Three of these items were in the tangibles dimension. When these items were removed, one item in the tangibles dimension exhibited an SMC below 0.50. Removing this item left only one item representing the tangibles dimension, so the entire dimension was removed. This result is consistent with Kettinger and Lee (1994) and with previous studies that demonstrated multi-dimensionality and low reliability for the tangibles dimension. The other items that were removed due to low SMC pertained to keeping users informed of when service is provided and courtesy. Keeping users informed of when service is provided was considered one of the least important items by customers when rating library service, only slightly higher than the items pertaining to the tangibles dimension. This item was also removed by Kettinger and Lee. The item pertaining to courtesy was rated only mildly important to customers, while the assurance dimension in general was not rated high in importance compared to other dimensions of service. These results indicate that the items pertaining to tangibles and the items pertaining to keeping users informed of when service is provided and courtesy are less relevant to Corps of Engineers library customers. The last item removed pertained to prompt service to users. This item exhibited an SMC of 0.52, only marginally higher than the 0.50 cutoff. It also exhibited a standardized residual greater than the 2.58 used for a cutoff by Kettinger and Lee. In addition, factor analysis revealed it loaded with a different dimension than the responsiveness dimension, which suggests the item may

point to more than one dimension. The final library SERVQUAL model consisted of 13 items.

The ML parameter estimates for the 13 items exhibited coefficients that were statistically significant ($p<0.01$) with t-values greater than 3.00. Fit indices for the library SERVQUAL model are shown in Table 33. While the chi-square was not small enough to indicate good fit of the model, large sample sizes and large numbers of indicators in a

Table 33.

Model Fit of Library SERVQUAL Model

Fit Indices	Suggested Cut-off Values	Library SERVQUAL	Kettinger & Lee SERVQUAL
X^2 (df)		210.72(61)	185.85(61)
$X^{2/df}$.	<= 5.00	3.45	3.04
GFI	>= .90	.92	.92
AGFI	>= .80	.88	.87
RMR	< .05	.03	.04

model may contribute to a significant chi-square value (Kettinger & Lee, 1994). In such cases Kettinger and Lee recommended using other types of fit indices, such as the chi-square/degree of freedom ($X^{2/df}$) index, adjusted goodness-of-fit (AGFI) index, goodness-of-fit (GFI) index, and root mean square residual (RMR).

A separate analysis on a correlation matrix of the same items was performed using LISREL, which resulted in identical fit indices to those obtained by AMOS. The indices provide evidence of adequate model fit and are similar to those obtained by Kettinger and Lee (1994).

A second-order confirmatory factor analysis was also performed on the 18 items of the library success instrument that made up the information center success instrument developed by Magal (1991). The initial model did not exhibit adequate fit, so items were eliminated with the same procedure used on the library SERVQUAL model.

First, 3 items with SMCs lower than 0.50 were removed. Two items belonged to the staff services dimension and pertained to access to library service and the relevance of library support to customer needs. The third item pertained to training customers in library services and was part of the user self-sufficiency dimension. The item pertaining to training was considered one of the least important items by library customers, and relevance of library support to needs was rated one of the least important items in the staff services dimension. The item pertaining to access had a higher number of missing responses, since it was not included on the Little Rock survey.

Table 34.

Model Fit of Library Success Model

Fit Indices	Suggested Cut-off Values	Library Success
X^2 (df)		308.04(62)
$X^{2/df}$.	<= 5.00	4.97
GFI	>= .90	.87
AGFI	>= .80	.81
RMR	< .05	.05

Two other items were removed due to marginally low SMCs and high standardized residuals. Feeling like a participant with the library had an SMC of 0.54 and

a standardized residual above the cutoff of 2.58. It was also the item rated lowest in importance by library customers. The item pertaining to fast response/turnaround time had an SMC of 0.53 and a standardized residual of 2.48, both of which were close to the cutoff points of 0.50 and 2.58. The item was also one of the staff service quality items rated low in importance by respondents. In addition, this was one of the items eliminated by Kettinger and Lee (1994). This left a model consisting of 13 items. However, the model still exhibited only marginal fit, as shown by the fit indices for the library success model in Table 34.

In order to compare results to Kettinger and Lee (1994), a second library success model was built using items from the User Satisfaction with the Information Services Function (USISF) measure. This consisted of 9 items: 2 pertaining to staff services, 4 to information quality, and 3 to user self-sufficiency. The second model based on items from the USISF measure resulted in a fit closer to that reported by Kettinger and Lee (1994). Fit indices for the second library success model are shown in Table 35.

Table 35.

Model Fit of USISF-Based Library Success Model

Fit Indices	Suggested Cut-off Values	Library Success based on USISF	Kettinger & Lee USISF
X^2 (df)		106.43(24)	90.4(24)
$X^{2/df}$.	<= 5.00	4.43	3.77
GFI	>= .90	.94	.94
AGFI	>= .80	.89	.87
RMR	< .05	.06	.04

Following the methodology of Kettinger and Lee (1994), the library SERVQUAL model and the library success model based on Kettinger and Lee's USISF items were combined. Initially, the combined SERVQUAL and library success model resulted in the responsiveness, assurance, and empathy dimensions exhibiting a loading greater than 1.0 and a corresponding negative error measurement. Such solutions are not appropriate and require correction before the model can be interpreted, according to Hair et al. (1995). These type errors occur frequently, and can result from a number of causes from sampling fluctuation to indefiniteness of the model (Dillon 1986). Dillon and Hair et al. recommended setting the offending variable to either zero or a small value, such as 0.005. After setting the error variances to 0.005, no offending estimates were evident in the results. Kettinger and Lee (1994) reported only the correlation between the two second-order latent factors and the $X^{2/df}$ score. The results of the combined model ($X^{2/df} = 4.87$) were similar to those reported by Kettinger and Lee ($X^{2/df} = 4.7$). The correlation between the two second-order latent factors was r =0.73, compared to Kettinger and Lee's r =-0.65. Whereas Kettinger and Lee found a negative correlation because of diametrically arranged adjectives between the instruments, this study used the same scale for both instruments. These results indicate that the library SERVQUAL instrument is significantly associated with the library success measure.

A regression analysis, following the procedure used by Kettinger and Lee (1994), was performed to address the question of whether some combination of library SERVQUAL and library success dimensions better predicts overall user satisfaction with the library. Seven variables pertaining to library service quality and library success were entered into an all possible regression with library satisfaction as the dependent variable.

These were the same variables examined by Kettinger and Lee (1994) and consisted of the reliability, responsiveness, assurance, and empathy factors from SERVQUAL, and the staff service quality, information quality, and user self-sufficiency factors from the library success measure.

Table 36.

Regression Results of Library Satisfaction on Selected Variables

Variable	Parameter Estimate	Standard Error	t-value	p-value
Intercept	0.743625	0.44359821	1.676	0.0945
RELIABILITY	0.288537	0.07241929	3.984	0.0001
SELFSUF	0.246235	0.06360217	3.871	0.0001
INFOQUAL	0.251641	0.08789899	2.863	0.0044
STAFFSERV	0.400878	0.09576858	4.186	0.0001
R^2	0.5074			
Adjusted R^2	0.5019			

After analysis for all possible regression permutations, the model with the highest adjusted R^2, 0.50, consisted of 4 variables. Three variables were from the library success measure and consisted of user self-sufficiency, information quality, and library service quality. The fourth variable was the reliability dimension from SERVQUAL. Kettinger and Lee (1994) found 5 variables as the best regression model. Four of these were the same as identified in this study. The fifth variable found by Kettinger and Lee was the empathy dimension from SERVQUAL. After identifying the best model, a separate regression was performed to examine t-values. Of the 4 variables found in this study,

library service from the library success measure was the most significant predictor and reliability from the SERVQUAL measure was second. These 4 variables accounted for 50% of the variation in library satisfaction. Results of the regression analysis are shown in Table 36.

These findings imply that the reliability dimension of library service quality is not adequately captured by any dimension of the library success measure, yet it is an important predictor of overall library user satisfaction and may be needed to supplement the library success measure. At the same time, these results indicate support for hypothesis 8 and suggest that library success is best measured using a combination of SERVQUAL and a library success measure that includes Magal's information center success measure. Results suggest that both instruments contain important predictors of library user satisfaction that are not completely captured by either instrument separately.

Table 37.

Regression Results of Library Service Quality on Selected Variables

Variable	Parameter Estimate	Standard Error	t-value	p-value
Intercept	2.045685	0.37600015	5.441	0.0001
RESPONSIVE	-0.254742	0.08900799	-2.862	0.0045
RELIABILITY	0.255145	0.07899750	3.230	0.0014
ASSURANCE	0.281669	0.08564989	3.289	0.0011
EMPATHY	0.086271	0.08164811	1.057	0.2914
STAFFSERV	0.455439	0.07235343	6.295	0.0001
INFOQUAL	0.247554	0.06669569	3.712	0.0002

R^2	0.5571
Adjusted R^2	0.5496

Although Kettinger and Lee (1994) did not attempt to determine if some combination of SERVQUAL and library success measures better predict library service quality than either measure separately, this question was examined in this study. The same 7 variables pertaining to library service quality and library success were entered into an all possible regression with library service as the dependent variable. The results of this regression analysis are shown in Table 37.

After analysis for all possible regression permutations, the model with the highest adjusted R^2, 0.55, consisted of 6 variables. Four variables were from the library SERVQUAL measure and consisted of reliability, responsiveness, assurance, and empathy. The other two variables were library staff service quality and information quality from the library success measure.

Although information quality may not appear at first to relate to library service quality, information can be considered both service and product (Goldhar, 1979). A separate regression on the variables identified in the best model revealed that staff service quality, information quality, assurance and reliability were the most significant predictors of library service quality. These 6 variables accounted for 55% of the variation in library service quality.

These results suggest that there are aspects of library service quality captured by the staff service quality and information quality dimensions of the library success measure that are not captured by any of the dimensions of SERVQUAL. This implies that library service quality is best measured using a combination of SERVQUAL and a library success measure, since both instruments contain important predictors of library service quality.

Library Success Instrument Based on Magal

Hypothesis 9 predicts that a library success instrument based on instruments for measuring information center and information system success exhibits similar reliability and validity to those instruments. In order to compare results to previous studies, reliability and validity analysis was first performed on portions of the library success instrument that correspond to Magal's measure of information center success and Seddon and Kiew's measure of information system success. A separate reliability and validity analysis was then performed on the combined library success instrument.

The portion of the library success instrument that corresponds to Magal's information center success measure consists of 7 items pertaining to library staff service quality, 6 items pertaining to information quality, and 5 items pertaining to user self-sufficiency. Since Magal (1991) used a single summary measure of success, a single summary measure of library satisfaction was used to indicate success for this portion of the analysis.

All of the performance measures showed higher correlation with overall library satisfaction than the importance measures. These results were the same as those reported by Magal (1991) and imply that rated performance is a better measure of library success than rated importance. The lowest correlation with overall library satisfaction was 0.45 (compared to 0.36 reported by Magal), and 13 out of 18 items had correlations greater than 0.50 (compared to 13 out of 16 greater than 0.50 reported by Magal).

Convergent validity of the library success instrument was checked by measuring the extent to which each item correlated with items in the same factor or dimension. All correlations were significant at the alpha = 0.01 level. All correlations among the quality

of information received were higher than 0.60 (compared to 0.50 reported by Magal). All correlations among the quality of user self sufficiency were higher than 0.49 (compared to 0.40 reported by Magal), and all correlations among the quality of library service were higher than 0.45 (compared to 0.40 reported by Magal). These correlations were all higher than those reported by Magal (1991) in a study of information center success and suggest convergent validity.

Discriminant validity was checked by counting how many times an item had a higher correlation with an item from another factor or dimension than with items in its own factor. Campbell and Fiske (1959) suggest that a count of less than half the potential comparisons is generally acceptable, or less than 50%. Magal (1991) found 48 instances out of 166 where the correlations were higher, or about 29%. Out of 214 cases, 74, or about 35%, had higher correlations in this study, suggesting discriminant validity.

Item-total correlations for the library success instrument were at least 0.63, with 16 of 18 measures greater than 0.70, indicating internal consistency. Magal (1991) found item-total correlations that were at least 0.67, with 14 of 16 measures greater than 0.70. Together with the high correlations of each measure with the overall measure of library satisfaction, these results indicate content validity.

Predictive validity was measured by performing a regression analysis. Library satisfaction was regressed against the 18 items of the library success instrument that correspond to the measure of information center success used by Magal (1991). This resulted in an adjusted R^2 value of 0.63, indicating that the instrument does possess predictive validity.

A principal components factor analysis using a varimax rotation was performed to test construct validity, following a procedure used by Magal (1991). Results of this factor analysis are shown in Table 38.

Table 38.

Rotated Matrix of Items Corresponding to Magal's Instrument

Rotated Component Matrix[a]

	Component		
	1	2	3
RELATESP		.816	
COMMP		.831	
COMPP		.770	
COOPP		.809	
FASTP		.696	
ACCESSP		.491	
RELNEEDP			.549
ACCUP	.826		
PRECISEP	.837		
RELIABLP	.845		
COMPLETP	.771		
RELEVP	.713		
CURRENTP	.746		
PARTICIP			.635
HOWTOP			.829
INDEPP			.830
CONTROLP			.793
TRAINP			.745

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Three factors emerged with eigenvalues greater than one, corresponding to the hypothesized dimensions of quality of library service, quality of information received,

and degree of user self sufficiency. Only one of the eighteen measures had a loading of less than the conventional 0.50, and it was 0.49. Also, only one item, relevance of library support to needs, did not load with the dimension with which it was theorized to belong. Instead, it loaded with the dimension pertaining to user self-sufficiency. These factors explained 75% of the variance. This was similar to findings reported by Magal (1991), where support was found for 3 factors that explained 63% of the variance.

The reliability of the factors was measured using Cronbach's alpha. The alphas of the 3 factors were all above the 0.80 alpha value recommended by Nunnally (1978), consisting of 0.91 for quality of library service; 0.89 for quality of user self-sufficiency; and 0.95 for quality of information received. Magal (1991) reported alphas of 0.87 for quality of information center service, 0.82 for quality of user self-sufficiency, and 0.86 for quality of user developed applications. These results indicate that the portion of the library success instrument used in this study that is based on Magal's information center success measure exhibits similar or better reliability and validity than Magal's instrument for measuring information center success.

Library Success Instrument Based on Seddon and Kiew

The portion of the library success instrument that corresponds to a measure of information system success used by Seddon and Kiew (1994) consists of 6 items pertaining to usefulness, 6 items pertaining to involvement, 4 items pertaining to system quality, and 6 items pertaining to information quality. Since Seddon and Kiew used a combination of 4 items to measure information system satisfaction, the same 4 items were used to indicate library satisfaction for this portion of the analysis. The lowest item correlations with library satisfaction were 0.24 and 0.38, both related to involvement. All

correlations were significant at the alpha = 0.01 level, and 16 out of 22 items had correlations greater than 0.50. All the items with correlations below 0.50 were related to involvement.

Convergent validity was checked by measuring the extent to which each item correlated with items in the same factor or dimension. All correlations were significant at the alpha = 0.01 level. All correlations among library usefulness were higher than 0.72. All correlations among library involvement were higher than 0.32. All correlations among library system quality (or online catalog) were higher than 0.91, and all correlations among library information quality were higher than 0.63. The 4 items that were used to measure library satisfaction all correlated higher than 0.72. These results suggest convergent validity.

Discriminant validity was checked by counting how many times an item had a higher correlation with an item from another factor or dimension than with items in its own factor. Campbell and Fiske (1959) have suggested that a count of less than half the potential comparisons is generally acceptable, or less than 50%. Results of this study indicate that only 22 out of 336 cases had higher correlations, or about 7%, suggesting that the instrument has strong discriminant validity. Item-total correlations ranged from 0.38 to 0.80, with 14 of 22 measures greater than 0.70. Items with the lowest item-total correlation pertained to involvement. Together with the high correlations of each measure with the overall measure of library satisfaction, these results show evidence of content validity.

A principal components factor analysis using a varimax rotation was performed to test construct validity, and 4 factors emerged with eigenvalues greater than 1. These

factors correspond to the hypothesized dimensions of library usefulness, involvement, system quality and information quality. None of the 22 items had a factor loading of less than the conventional 0.50, and all of the items loaded with the dimension with which it was theorized to belong. These factors explained 77% of the variance. Results of the rotated solution are shown in Table 39.

Table 39.

Rotated Matrix of Items Corresponding to Seddon and Kiew's Instrument

Rotated Component Matrix[a]

	Component			
	1	2	3	4
ACCUP		.855		
PRECISEP		.827		
RELIABLP		.846		
COMPLETP		.700		
RELEVP		.644		
CURRENTP		.691		
OPUSEP			.895	
OPLEARNP			.898	
OPCLEARP			.906	
OPSKILLP			.888	
FASTER	.784			
IMPROVES	.822			
ENHANCES	.828			
ENABLES	.832			
EASIER	.802			
USEFUL	.766			
IMPORTANT				.538
RELEVANT				.608
FUNDAME				.543
INTEREST				.864
APPEAL				.840
FACINATE				.599

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Predictive validity was measured by performing a regression analysis. Library satisfaction was regressed against the 22 items of the library success instrument that correspond to the measure of information system success used by Seddon and Kiew (1994). This resulted in an adjusted R^2 value of 0.74, indicating that the instrument does possess predictive validity.

The reliability of the factors was measured using Cronbach's alpha. The alphas of the 4 factors were all above the 0.80 alpha recommended by Nunnally (1978), consisting of 0.96 for usefulness, 0.85 for involvement, 0.98 for system quality, and 0.95 for quality of information received. The alpha for the library satisfaction measure was 0.95. Seddon and Kiew (1994) reported alphas of 0.99 for usefulness, 0.91 for involvement, 0.92 for system quality, 0.95 for quality of information, and 0.91 for library satisfaction. These results indicate that the library success instrument used in this study exhibits similar or better reliability and validity than Seddon and Kiew's instrument for measuring information system success.

Combined Library Success Instrument

A separate reliability and validity analysis was performed on the library success instrument based on a combination of an instrument used by Magal (1991) to measure information center success and an instrument used by Seddon and Kiew (1994) to measure information system success. This instrument consists of 12 items pertaining to library service quality, 4 items pertaining to system quality, 6 items pertaining to information quality, 5 items pertaining to user self-sufficiency, 6 items pertaining to usefulness, and 6 items pertaining to involvement. The library service quality items consist of 5 items from SERVQUAL that pertain to reliability and 7 items pertaining to

staff service quality from Magal's information center success instrument. Since Seddon and Kiew (1994) used a combination of 4 items to measure information system satisfaction, the same 4 items were used to indicate library satisfaction in this portion of the analysis.

A correlation analysis was performed to determine how well each item correlated with library satisfaction. All correlations were significant at the alpha = 0.01 level, and 32 out of 39 items had correlations greater than 0.50. The items with the lowest correlations with library satisfaction were related to involvement. Convergent validity was checked by measuring the extent to which each item correlated with items in the same factor or dimension. All correlations were significant at the alpha = 0.01 level. Correlations among library service quality were higher than 0.33. Correlations among system quality were higher than 0.91 and correlations among information quality were higher than 0.63. Correlations among usefulness were higher than 0.72. Correlations among user self-sufficiency were higher than 0.49, and correlations among library involvement were higher than 0.32. The 4 items that were used to measure library satisfaction correlated higher than 0.72. These results suggest convergent validity.

Discriminant validity was checked by counting how many times an item had a higher correlation with an item from another factor or dimension than with items in its own factor. Campbell and Fiske (1959) have suggested that a count of less than half the potential comparisons is generally acceptable, or less than 50%. Out of 1,540 cases, 271 had higher correlations, or about 18%, suggesting that the instrument has discriminant validity. Corrected item-total correlations ranged from 0.33 to 0.82, with 35 of 39 items greater than 0.60. Only one item pertaining to involvement had a corrected item-total

correlation less than the 0.35 recommended by Saxe and Weitz (1982). Together with the high correlations of each measure with the overall measure of library satisfaction, these results show evidence of content validity.

Predictive validity was measured by performing a regression analysis with library satisfaction against the 39 items that compose the library success instrument. An adjusted R^2 value of 0.85 was found, which is an indication of predictive validity.

A principal components factor analysis using a varimax rotation was performed to test construct validity, and 6 factors emerged with eigenvalues greater than 1. Four factors loaded in accord with the hypothesized dimensions of library service quality, usefulness, involvement, and information quality, but 2 factors, system quality and user self-sufficiency, loaded together. This may have been due to a high number of "unknown" system quality performance ratings at the Little Rock District site.

One factor did not correspond to any of the theoretical dimensions and was composed of items that loaded on more than a single factor. Four items had a loading of less than the conventional 0.50, but 2 of these were at the 0.49 level. Only 2 items, relevance of library support to customer needs, and feeling like a participant with the library, did not load with the dimensions with which they were theorized to belong. These factors explained 77% of the total variance. Results of the varimax rotated solution are shown in Table 40.

Table 40.

Rotated Matrix of Combined Library Success Instrument

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
PROMISEP		.765				
DEPENDP		.721				
FRSTIMEP		.829				
ATTIMEP		.844				
INFORMP		.571				.407
RELATESP		.494	.420			.418
COMMP		.518				.457
COMPP		.523				.429
COOPP		.526				.499
FASTP		.562				
ACCESSP		.413				
RELNEEDP	.461			.434		
ACCUP				.753		
PRECISEP				.722		
RELIABLP				.737		
COMPLETP				.665		
RELEVP	.427			.599		
CURRENTP				.607		
PARTICIP	.474					.554
HOWTOP	.649					.415
INDEPP	.692					
CONTROLP	.638					
TRAINP	.586					.492
OPUSEP	.878					
OPLEARNP	.860					
OPCLEARP	.869					
OPSKILLP	.877					
FASTER			.672			
IMPROVES			.757			
ENHANCES			.766			
ENABLES			.788			
EASIER			.771			
USEFUL			.638			
IMPORTANT					.524	
RELEVANT					.643	
FUNDAME					.535	
INTEREST					.858	
APPEAL					.831	
FACINATE					.485	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 10 iterations.

Because the system quality items had a high number of "unknown" values, a second factor analysis was performed on the combined library success items, and "unknown" values were replaced by the mean. Seven factors emerged with eigenvalues greater than 1. The items loaded on factors similar to the first factor analysis, except that system quality and user self-sufficiency loaded on separate factors, and involvement split into 2 factors.

The reliability of the factors was measured using Cronbach's alpha. The alphas of the 6 factors were all above the 0.80 alpha recommended by Nunnally (1978), consisting of 0.94 for library service quality, 0.98 for system quality, 0.95 for information quality, 0.96 for usefulness, 0.89 for user self-sufficiency, and 0.85 for involvement. The alpha for the library satisfaction measure was 0.95. These results indicate that the combined library success instrument used in this study exhibits similar or better reliability and validity than Magal's instrument for measuring information center success and Seddon and Kiew's instrument for measuring information system success.

Model of Library Success.

Hypothesis 10 states that increases in library service quality, information quality, system quality, user self-sufficiency, and involvement result in increases in perceived library usefulness, and increases in library service quality, information quality, system quality, user self-sufficiency, involvement, and usefulness result in increases in library satisfaction. Hypothesis 11 states that quality of library service predicts library satisfaction as well as or better than other variables associated with library success. A model of library success based on a combination of Magal's model of information center success and Seddon and Kiew's model of information system success was used to answer

hypotheses 10 and 11. The model consists of 6 independent variables related to library success: service quality, system quality, information quality, usefulness, user self-sufficiency, and involvement.

Table 41.

Regression Results of Library Satisfaction on Combined Instruments

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	229.610	6	38.268	83.511	.000[a]
	Residual	107.687	235	.458		
	Total	337.298	241			

a. Predictors: (Constant), SRVQUAL, LIBINVLV, SYSQUAL, LIBUSFL, SELFSUF, INFOQUAL

b. Dependent Variable: AVLIBSAT

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.053	.342		-3.081	.002
	LIBUSFL	.245	.057	.238	4.265	.000
	LIBINVLV	.147	.052	.122	2.806	.005
	SELFSUF	4.308E-02	.068	.040	.633	.527
	SYSQUAL	9.517E-02	.045	.114	2.108	.036
	INFOQUAL	.186	.085	.140	2.193	.029
	SRVQUAL	.469	.095	.343	4.950	.000

a. Dependent Variable: AVLIBSAT

Based on the findings from hypothesis 8, a combination of 7 items pertaining to staff service quality from the library success measure and 5 items pertaining to service

reliability from SERVQUAL were used to represent library service quality. Since Seddon and Kiew (1994) used a combination of 4 items to measure information system satisfaction, the same 4 items were used to indicate library satisfaction.

An all possible regression analysis in SAS was performed on the 6 library success independent variables using library satisfaction as the dependent variable. The regression model with the highest adjusted R^2, 0.67, consisted of 5 variables: service quality, involvement, usefulness, system quality, and information quality. Based on these results, a regression analysis using all variables was performed in SPSS to identify significant predictors of library satisfaction. Results indicated that library service quality and usefulness were strong predictors of library satisfaction and the only variable that was not a significant ($p < 0.05$) predictor of library satisfaction was user self-sufficiency. The results of this regression analysis are shown in Table 41.

A second regression analysis was performed on the same variables, with usefulness as the dependent variable. Results of this analysis indicate that only involvement and service quality are significant ($p < 0.01$) predictors of library usefulness. The adjusted R^2 was 0.555. Results of this regression analysis are shown in Table 42.

Based on these results, there is partial support for hypothesis 10. There is some indication that increases in library service quality, system quality, information quality, involvement, and usefulness results in increased library satisfaction, and that increases in service quality and involvement results in increases in library usefulness. However, there is no evidence that increased user self-sufficiency results in increased library satisfaction and only weak evidence that increased system quality results in increased library satisfaction. There is also no evidence that increases in user self-sufficiency, system

quality, or information quality results in increases in perceived library usefulness. There may be several reasons for these findings. The respondents in this study rated items pertaining to user self-sufficiency low, and many of the respondents indicated they relied on the library staff frequently. This suggests that these library users may not value user self-sufficiency highly, and this in turn may mean that for this group of library users, user self-sufficiency has little influence on satisfaction or perceived usefulness. At the same time user self-sufficiency and system quality appear to be highly correlated (0.723), and

Table 42.

Regression Results of Library Usefulness on Combined Instruments

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	179.221	5	35.844	61.017	.000[a]
	Residual	138.636	236	.587		
	Total	317.857	241			

a. Predictors: (Constant), SRVQUAL, LIBINVLV, SYSQUAL, SELFSUF, INFOQUAL

b. Dependent Variable: LIBUSFL

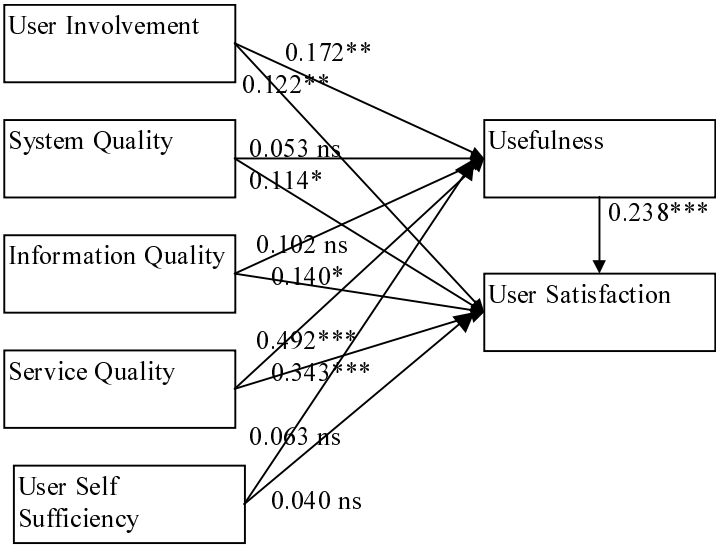
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.813	.383		-2.122	.035
	LIBINVLV	.202	.058	.172	3.479	.001
	SELFSUF	6.646E-02	.077	.063	.864	.389
	SYSQUAL	4.298E-02	.051	.053	.842	.401
	INFOQUAL	.131	.095	.102	1.373	.171
	SRVQUAL	.654	.099	.492	6.635	.000

a. Dependent Variable: LIBUSFL

the influence of one factor may be masking the influence of the other. Since system quality refers in this study to the library's online public access catalog and it's ease of use, there may be some relationship between a library user's feeling of independence and his or her ability to use the online catalog easily.

There is strong support for hypothesis 11 that library service quality predicts library satisfaction as well, or better than, other library success variables. If user satisfaction is the most general perceptual measure of information system success, as stated by Seddon and Kiew (1994), then it is important to determine which variables are strong predictors of user satisfaction. When a regression analysis with library satisfaction as the dependent variable was performed against variables associated with library success, library service quality exhibited higher standardized beta coefficient scores and



Significance levels: ***p<0.001, **p<0.01, *p<0.05, ns = not significant

Figure 6. Model of Library Success with Path Coefficients.

t-values than system quality, information quality, user involvement, user self-sufficiency, or library usefulness.

A model of library success was constructed showing the direction and influence of each library success variable on library usefulness and library satisfaction. Following the procedure used by Seddon and Kiew (1994), the standardized beta coefficients reported from the regression analysis were used as the path coefficients for each variable. This model indicates that library service quality affects both perceived library usefulness and library satisfaction more than any other library success variable. The library success model showing the path coefficients and significance level for each variable is shown in Figure 6.

CHAPTER 6

CONCLUSION

A discussion of the findings of the dissertation and problems encountered are presented in this chapter. Eleven hypotheses were posed to address the research objectives of this dissertation. Results and support for these hypotheses are summarized and discussed in this chapter. Recommendations for future research and a discussion of the implications of the study conclude the chapter.

Summary of the Study.

The purpose of this study was to test a library service quality and a library success instrument to examine their ability to measure library service quality and library success. The study was also designed to examine the effect library service quality has on library success. The library service quality instrument was based on a recent version of SERVQUAL developed by Parasuraman, Zeithaml, and Berry (1994). The library success instrument was based on an instrument developed by Magal (1991) to measure information center success and an instrument developed by Seddon and Kiew (1994) to measure information system success.

Mail surveys were conducted at two similar U.S. Army Corps of Engineer sites, one at Vicksburg, MS. and the other at Little Rock, AR. Out of a total of 1,095 survey forms sent out to library users at both sites, 385 responses were received, yielding a response rate of 37%. Most of the respondents were men (71%) engineers or scientists (68%) between the ages of 45 and 65 (51%). Most of the respondents, over 75%, were

frequent library users who relied frequently on library staff when using the library. These results suggest the respondents in this study were well qualified to rate the quality of library service at their location.

Summary of the Findings.

A number of findings related to library service quality and library success were identified in this study. The findings are summarized for each hypothesis that was investigated in this study.

> Hypothesis 1: Performance scores exhibit higher reliability and validity, and explain more variation in library service quality than difference scores.

Results of this study indicate strong support for hypothesis 1. Consistent with findings of a number of previous studies involving SERVQUAL, the findings of this study indicate that performance scores exhibit higher reliability and validity, and explain more variation in library service quality than difference scores. Performance scores displayed consistently higher reliability and validity scores in every measure. These results suggest that library service quality is best measured through performance scores alone because performance scores offer greater reliability and validity.

> Hypothesis 2: Performance minus importance scores exhibit higher reliability and validity, and explain more variation in library service quality than performance minus expectation scores.

Although this study found a significant difference between importance and expectation ratings, results show only partial support for hypothesis 2. Importance scores were rated lower and exhibited less variance restriction than expectation scores, and Smith (1995) has stated this provides a better fit to a gap-based theory of service quality. However, when importance and expectations were used to calculate service quality based on a difference score, performance minus expectation scores showed slightly higher reliability than performance minus importance scores. At the same time, performance minus importance scores predicted library service quality slightly better than performance minus expectations. These results suggest that neither performance minus importance nor performance minus expectation scores avoid the reliability and validity problems associated with difference scores.

Parasuraman, Zeithaml, and Berry (1994) have stated that expectations should be measured to provide management richer data. However, results from this study indicate that comparing service performance against what customers consider important may be just as useful to managers as comparing performance against what customers expect. Asking respondents to rate importance may be less confusing to respondents than asking them to rate their expectations of service. At the same time, results of this study indicate that measuring importance is different from measuring expectations, and service quality researchers should be careful to identify which they are measuring.

Hypothesis 3: The relative importance of service quality dimensions obtained by allocation of points to dimensions differs from those obtained by ratings of the importance of individual items.

Results indicate support for hypothesis 3. Although the general ranking order for the dimensions was similar when respondents were asked to rate the dimensions and the individual items, the dimension rated highest differed. When respondents rated the importance of individual items, responsiveness was the highest rated library service quality dimension. When respondents rated the importance of the dimensions, reliability was the highest rated library service quality dimension. More importantly, when the items rated highest in importance were examined, only 2 of the 5 items rated highest in importance were related to reliability. The item rated highest in importance related to responsiveness. At the same time, 1 item related to a dimension rated high in importance, reliability, was rated low in importance, while 1 item related to a dimension rated low in importance, assurance, was rated high in importance. These results suggest that rating only the importance of dimensions fails to identify which items within these dimensions are important to customers and could mislead managers to emphasize the wrong service items. If library managers want to know what service items to emphasize, then they should measure the importance of the items rather than the dimensions.

> Hypothesis 4: When expectations are described as what a library "can and should deliver", performance minus expectation scores predict library service quality better than library satisfaction, and performance minus importance scores also predict library service quality better than library satisfaction.

Results of this study indicate partial support for hypothesis 4. When expectations are described as what a library "should" deliver, performance minus expectation scores

predict library service quality than library satisfaction. Parasuraman, Zeithaml, and Berry (1988) have stated that expectations described as what a firm "should" offer are measuring service quality, and expectations described as what a firm "would" offer are measuring customer satisfaction (p. 17). Researchers have described expectations in both ways, and some researchers have directly substituted measures of importance for expectations, according to Smith (1995). When respondents are asked to rate what items are "absolutely essential" or "not at all essential", it is difficult to determine whether respondents are rating importance or expectations. One library survey asked respondents to rate each item based on how essential it is to satisfying their information needs (Maddox-Swan, 1998). Such lack of clarification in regard to expectations only adds to the confusion over whether SERVQUAL is measuring service quality or customer satisfaction. Since Parasuraman, Zeithaml, and Berry (1988) have stated that service quality is a different construct than customer satisfaction, it is critical to insure that SERVQUAL is measuring service quality rather than customer satisfaction.

In this study, expectations were described as "what an excellent library can and should deliver." Since the importance of each item was also measured, the two scores were compared to see how well they predicted library service quality and library satisfaction. Performance minus expectation scores predicted library service quality slightly better than library satisfaction, and performance minus importance scores predicted library satisfaction slightly better than library service quality. This indicates the two measures are measuring different constructs, as Smith (1995) suggested, and that expectations should be described as what a library "should" deliver in order to measure library service quality. The results also indicate that SERVQUAL researchers should be

careful not to confuse rating importance with expectations, since rating importance appears to be measuring a different construct, one that may be more related to satisfaction than service quality. At the same time, results of this study indicate that performance scores alone predicted library service quality better than either performance minus expectations or performance minus importance. If library researchers and managers want to measure library service quality, it appears that performance scores alone are sufficient, and may be preferable to either type of difference score.

> Hypothesis 5: When library service quality is calculated using performance or expectation scores, the number of dimensions SERVQUAL exhibits is different from when library service quality is calculated using difference scores, and library service quality exhibits either a 5 or 3-dimensional structure similar to that found by Parasuraman, Zeithaml, and Berry in 1994.

Results indicate support for hypothesis 5. When a factor analysis was performed on the performance and expectation scores, it resulted in a 3-factor solution, whereas a factor analysis of the difference scores resulted in a 4-factor solution. However, a varimax rotation revealed that the primary difference in the structures was that the tangibles dimension tended to split into two dimensions with the difference scores.

This study found evidence for a 3-dimensional structure of service quality similar to that found by Parasuraman, Zeithaml, and Berry in 1994. There was no support found for a 5-dimensional structure of service quality reported by Parasuraman, Zeithaml, and Berry (1994). Items from the responsiveness, assurance, and empathy dimensions tended

to dissolve into a single dimension. At the same time, there is evidence that different dimensional structures of library service quality may emerge if service quality is calculated using difference scores rather than performance scores. Service quality researchers should examine the dimensional structure for both types of scores in order to determine if performance scores have more dimensional stability than difference scores.

> Hypothesis 6: Perceptions of library service quality differ by gender occupation, and amount of reliance on library staff, but do not differ by age or frequency of use.

Partial support for hypothesis 6 was found. Results indicate no significant differences in library service quality ratings between age groups or occupations. However, significant differences in library service quality ratings were found between genders, between users who rely frequently on library staff and users who do not rely frequently on library staff, and between frequent library users and less frequent library users. Results indicate that women tended to rate library service quality higher than men. Also, users who relied frequently on library staff and frequent library users tended to rate library service quality higher than users who did not rely as frequently on library staff or who were less frequent library users.

The difference between the results reported in hypothesis 6 and results reported in previous library studies may be due to the different characteristics of the library users in this study. Whereas previous library service quality research has focussed on academic and public libraries, the libraries in this study were government research centers. Library

users were primarily engineers and scientists who were engaged in research directly related to funded projects. Some information science researchers have suggested that engineers acquire and use information differently than other occupations (Allen, 1977). Although no significant differences in service quality ratings were found between occupations, research engineers and scientists who depend on the library as part of their job may view library service quality differently than academic or public library users. Previous library research also indicated differences in perceptions of library service quality by gender (Nitecki, 1995), but it is not clearly understood why.

> Hypothesis 7: Library users who perceive the library as useful or who consider library service valuable rate library service quality higher, and library users who rate library service quality high are more likely to use the library in the future or to recommend the service to others.

Support was found for hypothesis 7. A significant difference was found in library service quality ratings between library users who considered library service high in value and usefulness and users who considered library service low in value and usefulness. Library users who rated the library high in value and usefulness tended to rate library service quality higher. A significant correlation was also found between library service quality ratings and the tendency for users to recommend the library to others or to use the library in the future. Library users who rated library service quality high were more likely to use the library in the future or to recommend the library service to others. These results suggest that service quality does impact behavioral intentions. However, stronger

correlations were found between library service quality ratings and library usefulness than correlations between library service quality ratings and willingness to use the library in the future or to recommend the library to others. These findings suggest that library usefulness may be a better indication of library service quality than anticipated future use.

> Hypothesis 8: A library success instrument and SERVQUAL together predict user satisfaction with the library better than a library success instrument alone, and both instruments predict library service quality better than SERVQUAL alone.

Support for hypothesis 8 was found. Confirmatory factor analysis with AMOS suggests that SERVQUAL is significantly associated with the library success instrument used in this study. Results indicate that the reliability dimension of library service quality is not adequately captured by any dimension of the library success measure, yet it is an important predictor of overall library user satisfaction. At the same time, results suggest that there are aspects of library service quality captured by the library success measure that are not captured by any of the dimensions of SERVQUAL, especially those pertaining to information quality. These findings imply that either library service quality or library success is best measured using a combination of SERVQUAL and a library success instrument. Measuring only library service quality with SERVQUAL fails to measure other important variables associated with library satisfaction, such as system quality, information quality, usefulness, and user involvement. Both instruments predict library service quality and library satisfaction better than either instrument alone.

Hypothesis 9: A library success instrument based on instruments for measuring information center and information system success exhibits similar reliability and validity to instruments used to measure information center and information system success.

Support for hypothesis 9 was found. A separate reliability and validity analysis was performed on the portion of the library success instrument that corresponded to Magal's information center success measure, to Seddon and Kiew's information system success measure, and to a combination of both instruments. Separate analyses were performed in order to be able to compare results to those obtained in previous studies.

The portion of the library success instrument that corresponds to Magal's information center success instrument exhibited similar reliability and validity to that reported by Magal (1991) when studying information centers. Since information centers and libraries share similar missions and functions, results indicate that it is possible to apply Magal's instrument for measuring information center success to libraries. The portion of the library success instrument that corresponds to Seddon and Kiew's information system success instrument also exhibited similar reliability and validity to that reported by Seddon and Kiew (1994) when studying an information system. These results indicate that it is possible to apply Seddon and Kiew's instrument for measuring information system success to libraries.

Magal's instrument and Seddon and Kiew's instrument were developed to measure similar, but different constructs. However, since both originated from an instrument

developed by Bailey and Pearson (1983), it should be possible to combine both instruments into a single instrument to measure library success. The combined library success instrument used in this study exhibited similar reliability and validity to Magal's and to Seddon and Kiew's instrument, implying that the combined instruments can be used to measure library success.

> Hypothesis 10: Increases in library service quality, information quality, system quality, user self-sufficiency, and involvement result in increases in perceived library usefulness, and increases in library service quality, information quality, system quality, user self-sufficiency, involvement, and usefulness result in increases in library satisfaction.

Partial support for hypothesis 10 was found. Results indicate that increases in library service quality, system quality, information quality, involvement, and usefulness will result in increased library satisfaction, and increases in service quality and involvement will result in increases in library usefulness. However, results did not indicate that increases in user self-sufficiency will result in increases in library satisfaction, and there was only weak evidence that increases in system quality will result in increased library satisfaction. Results also did not indicate that increases in user self-sufficiency, system quality, or information quality results in increases in perceived library usefulness.

The reason for the differences in the findings of this study and previous studies may be due to the unique characteristics of these library users. Although Magal (1991)

conjectured that user self-sufficiency, or user independence, influences information center success, the respondents in this study tended to rate the importance of user self-sufficiency low and relied frequently on library staff when using the library. Since these respondents were primarily research engineers and scientists, they may feel their time is valuable and prefer to rely more heavily on library staff than other users. This finding may have important implications for today's libraries. In spite of access to network resources, it appears that some library users prefer to rely on library staff when using the library. A library that concentrates solely on end-user independence may be neglecting an important factor in library success, personal service to customers. This may be particularly true in a special library environment, where the clientele are largely working professionals. At the same time, putting a virtual library on the Internet may not be effective unless the library staff also offers personal service in conjunction with electronic access.

Hypothesis 11: Quality of library service predicts library satisfaction as well as or better than other variables related to library success.

Strong support for hypothesis 11 was found. Results indicate that library service quality effects both perceived library usefulness and library satisfaction more than any other library success variable. These findings suggest that library service quality is an important dimension of library success and that the model of information system success developed by DeLone and McLean (1992) should be modified to include service quality. Results also suggest that service quality is an important factor in library satisfaction and

Table 43.

Summary of Support for Hypotheses.

Hypothesis	No Support	Partial Support	Full Support	Strong Support
1. P scores more reliable and valid than P-E scores.				P scores higher alpha and R^2
2. P-I scores more reliable and explain more variation in library service quality than P-E scores.		P-E scores higher alpha, P-I scores higher R^2		
3. Dimensions ranked different from items.			Most important dimension differs	
4. P-E and P-I scores predict service quality better than satisfaction.		Only P-E scores higher quality R^2		
5. SERVQUAL exhibits either 5 or 3 dimensions.			3 factors with eigenvalues > 1	
6. Significant differences in perceived quality between gender, occupation, and amount of reliance on library staff.		Gender and reliance significant at $p < .05$, no significant difference in occupation		
7. Users who rate library service quality high are more likely to use the library in the future and to recommend service to others.			Significant ($p = .01$) correlation between rating and behavioral intentions	
8. Combined instruments better than either alone.			Highest R^2 from combination	
9. Library success instrument similar to other success instruments.			Instruments exhibited similar alphas and R^2	
10. Increases in involvement, usefulness, service quality, and self sufficiency results in increases in user satisfaction.		Involvement, usefulness, service significant at $p < .01$, self sufficiency not significant		
11. Library service quality predicts library satisfaction better than other success variables.				Service quality highest beta coefficient and t value

library usefulness. If libraries want to measure library success, they should include a measure of service quality. At the same time, if libraries want to obtain higher user satisfaction, they can not neglect service quality. A summary showing the strength of support found for each hypothesis investigated in this study is shown in Table 43.

Problems Encountered.

The primary problem encountered in this study was the low response rate to the mail survey at Vicksburg. A better response rate could probably have been attained if a random sample from the database of library users at Vicksburg had been used rather than the entire database. The database included library users who had visited the Vicksburg library only once or twice, and some of these users may not have responded because they did not feel qualified to rate the quality of library service. Also, some library users may not have responded because of the length of the survey, although the survey only took about 15 minutes to complete. The library users in this study were primarily professional engineers and scientists working on deadlines, who may have felt their time was too valuable to fill out the survey. In addition, there have been a number of surveys taken at Vicksburg as part of U.S. Army Corps of Engineers personnel studies, and some respondents may have felt they had answered too many surveys.

Low response rates are often a limitation of mail surveys, and a response rate greater than 30% is rare (Alreck & Settle, 1985). Many mail surveys encourage higher response rates through financial incentives. However, the legal office at Vicksburg discouraged any type of financial incentive. Every means available was used to encourage responses, including a cover letter signed by the WES director and a self-addressed envelope for returns. Although eliminating some redundancy of two similar

instruments would have reduced the length of the survey instrument, all the questions needed to be included in order to compare results with previous studies. At the same time, a number of SERVQUAL studies have reported response rates below 30%, so the response rate encountered in this study was not considered unusual.

Many of the scores in this survey exhibited a negative skew and positive kurtosis beyond that recommended by Morgan and Griego (1998). However, the scores reported are similar to those found in previous library studies that involved SERVQUAL. Morgan and Griego stated that even when scores violate assumptions of normality, parametric statistics may be preferred over nonparametric statistics because of the more robust nature of parametric statistics. Previous studies that reported similar scores to those in this study utilized parametric tests to analyze data and draw conclusions, so the same tests were utilized in this study in order to compare results with earlier research.

Recommendations for Future Research

Future research into library service quality should investigate ways to combine both SERVQUAL and a library success instrument into a single instrument in order to shorten the survey and increase response rates. Based on the results of this study, SERVQUAL may be better represented by three dimensions reflecting the quality of the library service environment, quality of service provided, and quality of service delivery. SERVQUAL items that exhibited a high number of unknown responses could be eliminated or replaced by items from the staff service dimension of the library success instrument. Two summary statements pertaining to service quality and satisfaction should be used because they appear to measure different constructs. Questions pertaining to expectations could be replaced by questions pertaining to importance, and questions

pertaining to the importance of SERVQUAL's dimensions could be eliminated, further reducing the length and complexity of the instrument. Because of the low importance of items in the tangibles dimension found in this study, library researchers need to explore whether these items should be re-written to reflect issues that are more important to library customers, or whether this dimension should be eliminated as advocated by Kettinger and Lee (1997). A suggested version of this new instrument is shown in Appendix E.

If performance scores are the most reliable and valid method of measuring service quality, then a theory of service quality based on performance alone needs to be assessed. Because of the inherent confusion regarding expectation scores, re-phrasing performance items to include expectations may prove just as problematic as difference scores. Also, the solution proposed by Parasuraman, Zeithaml, and Berry (1994) to split expectation scores into a zone of tolerance does not avoid the problems associated with difference scores, if expectation scores are subtracted from performance scores in order to obtain a measure of service quality. It is not enough to say that performance scores are operationally better than difference scores, as long as the theory of service quality relies on customer expectations as part of the service quality equation. Future research into library service quality must examine new theories of service quality in order to build an instrument based on performance alone, or investigate ways to incorporate expectations into the performance measure without using a difference score method to calculate service quality.

Additional study needs to examine how importance scores might be used with service performance scores for management purposes, and whether importance scores or

customer expectations provide more valuable feedback to management. A number of methods of placing performance scores in perspective to expectations or importance need to be explored. Researchers should examine the use of importance/performance maps or multi-dimensional scaling and gauge how useful this information is for managers compared to expectations. Methods of importance-performance mapping such as those advocated by Martilla and James (1977) or Hawes & Rao (1985) should be re-examined to determine if they offer more information for management than expectations.

Further investigation needs to be performed into a 3-dimensional model of library service quality. The 3 dimensions found in this study should be examined to identify how they represent aspects of library service. For example, the tangibles dimension may be considered in a broader context of the service environment and encompass items related to the size and quality of the library collection. Items from the reliability dimension may be considered part of service performance and should reflect how capably service is performed. Items from the responsiveness, assurance, and empathy dimensions may be combined to reflect the manner in which service is delivered, or aspects of customer care.

In addition, further research is needed to examine the variables associated with library satisfaction to identify a better model of library success, and if there are different models for different kinds of libraries. Based on the results of this study, the variables that most influence library satisfaction in a special library environment are user involvement, information quality, system quality, service quality, and usefulness. Library usefulness appears to be influenced in turn by user involvement, information quality, and service quality. Although user self-sufficiency was not found to significantly affect library satisfaction or usefulness in this study, more research needs to examine this issue.

At a time when many libraries are focussing strongly on teaching users to become independent, it is critical to determine how user independence relates to overall satisfaction with the library. These findings are also potentially important in determining how library services are delivered in electronic environments such as the Internet.

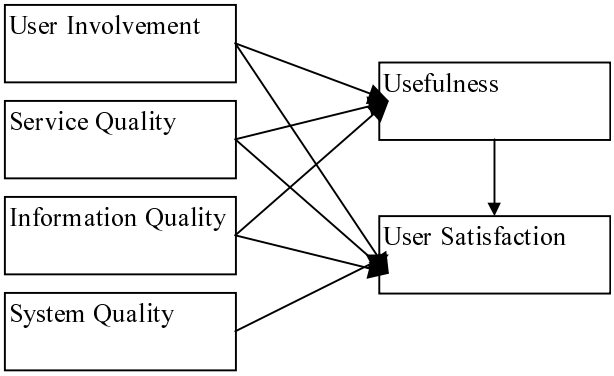


Figure 7. Proposed Model of Special Library Success.

Although user self-sufficiency does not appear to influence library satisfaction within a special library context, user self-sufficiency may influence library satisfaction more in other types of libraries, such as public or academic libraries. At the same time, system quality does not appear to influence usefulness in special libraries when system quality is defined as ease of system use. An easy to use online card catalog may influence library satisfaction, but it may not have much impact on how useful customers feel the

library is to them. A proposed model of special library success, incorporating the results of this study, is shown in Figure 7.

Implications and Concluding Summary

Several improvements to SERVQUAL were identified in this study to assist managers and researchers in measuring library service quality more effectively. Results strongly indicate that a performance-based version of SERVQUAL, such as SERVPERF, is a more effective operational measure of library service quality than a difference-based version of SERVQUAL. At the same time, if library managers and researchers desire to measure expectations, they should be careful to insure they are not measuring importance. Also, if library managers are concerned about the importance of different areas of service being provided, they should have respondents rate the importance of each item rather than the importance of each dimension. Having respondents rate only the importance of dimensions may cause managers to target the wrong items.

Evidence was also found in this study that SERVQUAL and instruments developed to measure information center and information system success should be combined to more effectively measure library service quality and library success. Results of this study indicate that although a number of factors, such as information quality, system quality, involvement, and usefulness, contribute to library success, service quality is one of the most important factors of library success. Library managers who are attempting to assess how successfully their libraries meet customers' needs should include some measure of library service quality from the user's perspective. At the same time, library managers should be aware that service quality is only one factor that contributes to library success, and it may not be enough just to measure service quality.

Instruments developed to measure information center and information system success should be combined with service quality measures to insure library success is being adequately measured.

At a time when libraries are struggling to compete both financially and technologically with other information providers, it is critical that managers be able to assess the quality of service being provided from the user's perspective, and whether that service translates into satisfaction with the library and ultimately library success. In this study, a model of library success was developed in order to clarify how service quality relates to user satisfaction as a measure of library success, and a new instrument was developed to measure both library service quality and library success. Combining measures of library service quality with library success should help library managers better evaluate the quality of service being provided by the library and more effectively gauge how successfully the library is meeting the needs of library users.

APPENDICES

APPENDIX A

LITTLE ROCK SURVEY COVER LETTER

CEIM-IL 5 Jan 1998

SUBJECT: Library Survey RCS No. CEIM-IL(OT)123

Dear Library User:

We are asking for your help. Please take a minute to read this memo. The U.S. Army Corps of Engineers (USACE) Library Program and Mr. Hollis Landrum, a Ph.D. candidate in the Interdisciplinary Information Science Program at the University of North Texas, are currently involved in a study of the quality of library service within USACE. Results will be used to improve library service to USACE users and to develop an instrument to measure the quality of service provided by libraries.

Attached to this letter is a brief questionnaire that takes about 15 minutes to complete. It asks a variety of questions regarding the level of library service you desire and how well the library at your organization is meeting those needs. We are asking a randomly selected group of USACE personnel to complete the questionnaire and to send it back to us at the USACE Library Program Office in the self-addressed envelope provided. Do not write your name on the questionnaire. We do not need to know who you are. We emphasize that this is a research project. We guarantee that your choice to participate and your responses if you do participate will not be identified with you personally.

We hope you will help us with this project. Understanding what library services USACE personnel desire and how well USACE libraries are meeting those needs is important to us, and will enable the USACE Library Program to provide better service for library users in the future. We are grateful for your participation, and thank you for your assistance.

Cordially,

Carol McMillin
USACE Library Program Manager (CEIM-IL)

This project has been reviewed and approved by the UNT Committee for the Protection of Human Subjects (940) 565-3940.

APPENDIX B

LITTLE ROCK SURVEY INSTRUMENT

Section A. DIRECTIONS: ***We want your impressions about how the library at your organization performs relative to your expectations. For each of the following features, please indicate: (a) how important each feature is to you by circling a number in the first column; (b) the level of library service you believe an excellent library can and should deliver by circling a number in the second column; and (c) your perception of the library's performance at your organization by circling a number in the third column. There are no right or wrong answers. If you are unsure how to rate the library's performance, circle the number under "unknown". Please do not omit any feature.***

	How important this feature is to me.	**What an excellent library can and should deliver.**	**How the library performs here.**	
	low high	**low high**	**low high**	**unknown**
When it comes to…				
1. Modern equipment.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
2. Visually appealing facilities.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
3. Neat, professionally appearing staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
4. Visually appealing documentation, such as library signs, handouts, and brochures.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
5. Convenient hours of operation.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
6. Providing service as promised.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
7. Dependability in handling users' service problems.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
8. Performing service right the first time.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
9. Providing service at the promised time.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
10. Keeping users informed about when services will be performed.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
11. Prompt service to users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
12. Willingness to help users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
13. Readiness to respond to users' requests.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
14. Courteous staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
15. Staff who instill confidence in users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
16. Making users feel safe in their transactions with the library.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
17. Staff who have the knowledge to answer users' questions.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
18. Giving users individual attention.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
19. Staff who have the users' best interests at heart.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
20. Staff who deal with users in a caring fashion.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
21. Staff who understand the needs of users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
22. Good relations between staff and users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
23. Communication between staff and users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
24. Technical competence of library staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
25. Cooperative attitude of library staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
26. Fast response/turnaround time.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
27. Relevance of library support to needs.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
28. Training on use of the library resources.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
29. Accuracy of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
30. Precision of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
31. Reliability of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**

	How important this feature is to me.		What an excellent library can and should deliver.		How the library performs here.		
	low	high	low	high	low	high	unknown
When it comes to…							
32. Completeness of information received.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
33. Relevance of information received.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
34. Currency of information received.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
35. Feeling like a participant with the library.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
36. Understanding how to use the library.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
37. Being able to use the library independently.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
38. Feeling of control when using the library.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
39. An online catalog that is easy to use.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
40. Learning to use the online catalog easily.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
41. Being able to get the online catalog to do what I want to do easily.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
42. Interacting with the online catalog in a clear and understandable way.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
43. An online catalog that is flexible to use.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0
44. An online catalog that is easy to become skillful at using.	1 2 3 4 5 6 7		1 2 3 4 5 6 7		1 2 3 4 5 6 7		0

45. Please identify any other service you expect or desire in excellent libraries: _____

Section B. DIRECTIONS: Listed below are five features pertaining to libraries and the service they offer. We would like to know how important each of these features is to you when you evaluate a library's quality of service. Please allocate a total of 100 points among the five features according to how important each feature is to you – the more important a feature is to you, the more points you should allocate to it. Please ensure that the points you allocate to the five features add up to 100.

1. The appearance of the library's physical facilities, equipment, and personnel. **___ points**
2. The library's ability to perform the promised service dependably and accurately. **___ points**
3. The library's willingness to help users and provide prompt service. **___ points**
4. The knowledge and courtesy of the library's staff and their ability to convey trust and confidence. **___ points**
5. The caring, individualized attention the library provides users. **___ points**

Total points allocated **100 points**

6. Which feature among the above five is most important to you? (please enter the feature's number) _____
7. Which feature is least important to you? _____
8. Please identify any other feature you consider important in evaluating the quality of library service:_____

Section C. DIRECTIONS: ***Please circle the number according to how strongly you agree or disagree with each statement regarding the library at your organization***

	strongly disagree						strongly agree
1. The library enables me to accomplish tasks faster.	1	2	3	4	5	6	7
2. The library improves my job performance.	1	2	3	4	5	6	7
3. The library enhances my effectiveness on the job.	1	2	3	4	5	6	7
4. The library enables me to increase my productivity.	1	2	3	4	5	6	7
5. The library makes it easier to do my job.	1	2	3	4	5	6	7
6. Overall I find the library at this organization useful.	1	2	3	4	5	6	7

Section D. DIRECTIONS: ***For each item below, circle the number or mark the block that best reflects how you feel about the library at your organization.***

1. Compared to the benefits, how do you rate the cost of library service at your organization?
   poor value 1 2 3 4 5 6 7 excellent value
2. How adequately does the library at your organization meet your information needs?
   inadequate 1 2 3 4 5 6 7 adequate
3. How effective is the library at your organization?
   ineffective 1 2 3 4 5 6 7 effective
4. How efficient is the library at your organization?
   inefficient 1 2 3 4 5 6 7 efficient
5. How satisfied are you with the library at your organization as a whole?
   dissatisfied 1 2 3 4 5 6 7 satisfied
6. Overall, how would you rate the **quality of service** provided by the library?
   poor 1 2 3 4 5 6 7 excellent
7. Overall, how satisfied are you with the **service** provided by the library?
   dissatisfied 1 2 3 4 5 6 7 satisfied
8. For you personally, the library at your organization is:
   (***Please put a check mark in the space on each line below closest to your opinion of the library.***)

unimportant	____:____:____:____:____:____:____	**important**
relevant	____:____:____:____:____:____:____	**irrelevant**
trivial	____:____:____:____:____:____:____	**fundamental**
interesting	____:____:____:____:____:____:____	**boring**
appealing	____:____:____:____:____:____:____	**unappealing**
mundane	____:____:____:____:____:____:____	**fascinating**

Section E. DIRECTIONS: ***Please answer a few more questions concerning your use of the library at your organization. Circle your response or provide the requested information for each item below:***

1. How many times during the past year have you used or requested service from the library?
   none once 2 to 5 times 6 to 10 times 11 or more times
   1 2 3 4 5
2. How many times during the past year have you used the library's online catalog?
   none once 2 to 5 times 6 to 10 times 11 or more times
   1 2 3 4 5
3. How often do you rely on library staff when using the library?
   none infrequently frequently nearly always always
   1 2 3 4 5
4. Do you intend to use the library at your organization in the future?
   not at all likely 1 2 3 4 5 6 7 extremely likely
5. Would you recommend others to use the library at your organization?
   not at all likely 1 2 3 4 5 6 7 extremely likely
6. Date of birth **(m/d/y)**: _____ 7. Gender **(circle one)**: **M F**
8. Job series or occupation code:_____

Thank you for your participation.

APPENDIX C

VICKSBURG SURVEY COVER LETTER

CEWES-ZA 6 April 1998

MEMORANDUM FOR DISTRIBUTION

SUBJECT: Library Survey RCS No. CEIM-IL(OT)123

1. The U.S. Army Corps of Engineers (USACE) Library Program is conducting a study of the quality of library service within USACE. Results will be used to improve library service to USACE users and to develop an instrument to measure the quality of service provided by libraries.

2. Attached to this letter is a brief questionnaire that takes about 15 minutes to complete. It asks a variety of questions regarding the level of library service you desire and how well the library at the U.S. Army Engineer Waterways Experiment Station (WES) is meeting your needs. A randomly selected group of WES personnel are being asked to participate in this survey. Remove the cover letter and return the completed survey in the self-addressed envelope provided. Do not write your name on the questionnaire. If you choose to participate, your responses will not be identified with you personally.

3. I hope you will take a moment to help with this project. Understanding what library service WES personnel desire and how well the library is meeting those needs is important and will enable the library to provide better service. Your participation and assistance in this project are appreciated.

4. Principal investigator for the study is Mr. Hollis Landrum, a Ph.D. candidate in the Interdisciplinary Information Science Program at the University of North Texas (UNT). You may contact Mr. Landrum at ext. 3561 with any questions concerning the survey. In accordance with the requirements of the Office of Research Administration at UNT, this project has been reviewed and approved by the UNT Committee for the Protection of Human Subjects (phone 940-564-3940).

ROBERT W. WHALIN, Ph.D., PE
Director

APPENDIX D

VICKSBURG SURVEY INSTRUMENT

Section A. DIRECTIONS: ***We want your impressions about how the Waterways Experiment Station Research Library performs relative to your expectations. For each of the items below, please indicate: (a) how important each item is to you by circling a number in the first column; (b) the level of library service you believe an excellent library can and should deliver by circling a number in the second column; and (c) your perception of the library's performance by circling a number in the third column. There are no right or wrong answers. If you are unsure how to rate the library's performance, circle the number under "unknown". Please do not omit any feature.***

	How important this item is to me.	**What an excellent library can and should deliver.**	**How the library performs here.**	
	low high	**low high**	**low high**	**unknown**
When it comes to…				
1. Modern equipment.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
2. Visually appealing facilities.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
3. Neat, professionally appearing staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
4. Visually appealing documentation, such as library signs, handouts, and brochures.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
5. Convenient hours of operation.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
6. Providing service as promised.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
7. Dependability in handling users' service problems.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
8. Performing service right the first time.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
9. Providing service at the promised time.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
10. Keeping users informed about when services will be performed.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
11. Prompt service to users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
12. Willingness to help users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
13. Readiness to respond to users' requests.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
14. Courteous staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
15. Staff who instill confidence in users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
16. Making users feel secure in their transactions with the library.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
17. Staff who have the knowledge to answer users' questions.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
18. Giving users individual attention.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
19. Staff who have the users' best interests at heart.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
20. Staff who deal with users in a caring fashion.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**
21. Staff who understand the needs of users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**	**0**

Section B. DIRECTIONS: ***Please circle a number below according to how strongly you agree or disagree with each statement regarding the Waterways Experiment Station Research Library.***

	strongly disagree						**strongly agree**
1. The library enables me to accomplish tasks faster.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. The library improves my ability to do research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. The library enhances my effectiveness.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. The library enables me to be more productive.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. The library makes it easier to do research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Overall I find the library at this organization useful.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Section C. DIRECTIONS: ***For each of the items below, please indicate: (a) how important each item is to you by circling a number in the first column; and (b) your perception of the Waterways Experiment Station Research Library's performance by circling a number in the second column. There are no right or wrong answers. If you are unsure how to rate the library's performance, circle the number under "unknown". Please do not omit any feature.***

	How important this item is to me.		**How the library performs here.**		
	low	**high**	**low**	**high**	**unknown**
When it comes to…					
1. Good relations between staff and users.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
2. Communication between staff and users.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
3. Technical competence of library staff.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
4. Cooperative attitude of library staff.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
5. Fast response/turnaround time.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
6. Convenient access to the library.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
7. Training on use of library resources.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
8. Relevance of library support to needs.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
9. Accuracy of information received.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
10. Precision of information received.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
11. Reliability of information received.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
12. Completeness of information received.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
13. Relevance of information received.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
14. Currency of information received.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
15. Feeling like a participant with the library.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
16. Understanding how to use the library.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
17. Being able to use the library independently.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
18. Feeling that you are in control when you use the library.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
19. An online catalog that is easy to use.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
20. An online catalog easy to learn to use.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
21. An online catalog that you can interact with in a clear and understandable way.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
22. An online catalog that is easy to become skillful at using.	**1 2 3 4 5 6 7**		**1 2 3 4 5 6 7**		**0**
23. Please identify any other service you expect or desire in excellent libraries:_____					

Section D. DIRECTIONS: ***Listed below are five features pertaining to libraries and the service they offer. We would like to know how important each of these features is to you when you evaluate a library's quality of service. Please allocate a total of 100 points among the five features according to how important each feature is to you – the more important a feature is to you, the more points you should allocate to it. Please ensure that the points you allocate to the five features add up to 100.***

1. The appearance of the library's physical facilities, equipment, and personnel. **___ points**
2. The library's ability to perform the promised service dependably and accurately. **___ points**
3. The library's willingness to help users and provide prompt service. **___ points**
4. The knowledge and courtesy of the library's staff and their ability to convey trust and confidence. **___ points**
5. The caring, individualized attention the library provides users. **___ points**

Total points allocated: 100 points

Section E. DIRECTIONS: ***For each item below, circle the number or mark the space that best reflects how you feel about the Waterways Experiment Station Research Library.***

1. How do you rate the value of library service at Waterways to you personally?
   poor value 1 2 3 4 5 6 7 excellent value
2. How adequately does the library at Waterways meet your information needs?
   inadequate 1 2 3 4 5 6 7 adequate
3. How effective is the library at Waterways?
   ineffective 1 2 3 4 5 6 7 effective
4. How efficient is the library at Waterways?
   inefficient 1 2 3 4 5 6 7 efficient
5. How satisfied are you with the library at Waterways as a whole?
   dissatisfied 1 2 3 4 5 6 7 satisfied
6. Overall, how would you rate the **quality of service** provided by the library at Waterways ?
   poor 1 2 3 4 5 6 7 excellent
7. Overall, how satisfied are you with the **service** provided by the library at Waterways?
   dissatisfied 1 2 3 4 5 6 7 satisfied
8. For you personally, the library at Waterways is:
   (***Please put a check mark in the space on each line below closest to your opinion of the library.***)

unimportant	____:____:____:____:____:____:____	**important**
relevant	____:____:____:____:____:____:____	**irrelevant**
trivial	____:____:____:____:____:____:____	**fundamental**
interesting	____:____:____:____:____:____:____	**boring**
appealing	____:____:____:____:____:____:____	**unappealing**
mundane	____:____:____:____:____:____:____	**fascinating**

Section F. DIRECTIONS: ***Please answer a few more questions concerning your use of the Waterways Experiment Station Research Library. Circle your response or provide the requested information for each item below:***

1. How many times have you used or requested service from the library?
   none once 2 to 5 times 6 to 10 times 11 or more times
   1 2 3 4 5
2. Have you ever paid for library service with a work item code (job number)?
   Yes No
   1 2
3. How many times have you used the library's online catalog?
   none once 2 to 5 times 6 to 10 times 11 or more times
   1 2 3 4 5
4. How often do you rely on library staff when using the library?
   none infrequently frequently nearly always always
   1 2 3 4 5
5. Do you intend to use the library at Waterways in the future?
   not at all likely 1 2 3 4 5 6 7 extremely likely
6. Would you recommend others to use the library at Waterways?
   not at all likely 1 2 3 4 5 6 7 extremely likely

7. Age **(circle one): 25 or below 45 or below 65 or below Above 65**

8. Gender **(circle one)**: **M F**

9. Job category **(circle one): Engineer Scientist Technician Administrative Other**

Thank you for your participation.

APPENDIX E

SUGGESTED FUTURE SURVEY INSTRUMENT

Section A. DIRECTIONS: ***We want your impressions about how the library at your facility performs relative to your desires. For each of the items below, please indicate how important each item is to you by circling a number in the first column and your perception of the library's performance by circling a number in the second column. There are no right or wrong answers. Please do not omit any feature.***

	How important this item is to me.	**How the library performs here.**
	low high	**low high**
When it comes to…		
Quality of Library Environment		
1. Visually appealing facilities.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
2. Convenient hours of operation.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
3. Convenient access.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
Quality of Library Service		
4. Providing service as promised.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
5. Dependability in handling users' problems.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
6. Performing service right the first time.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
7. Providing service at the promised time.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
8. Relevance of library service to users' needs.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
Quality of Service Delivery		
9. Good relations between staff and users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
10. Communication between staff and users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
11. Prompt service to users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
12. Willingness to help users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
13. Readiness to respond to users' requests.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
14. Cooperative attitude of library staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
15. Staff who instill confidence in users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
16. Technical competence of library staff.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
17. Giving users individual attention.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
18. Dealing with users in a caring fashion.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
19. Staff who understand the needs of users.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
Quality of Information		
20. Accuracy of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
21. Precision of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
22. Reliability of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
23. Completeness of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
24. Relevance of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
25. Currency of information received.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
User Independence		
26. Training on use of library resources.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
27. Feeling like a participant with the library.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
28. Understanding how to use the library.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
29. Feeling that you are in control when you use the library.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
Quality of Library Online Catalog		
30. An online catalog that is easy to use.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
31. An online catalog that is easy to learn to use.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**
32. An online catalog that you can interact with in a clear and understandable way.	**1 2 3 4 5 6 7**	**1 2 3 4 5 6 7**

Section B. DIRECTIONS: ***Please circle a number below according to how strongly you agree or disagree with each statement regarding the library at your facility.***

	strongly disagree						strongly agree
1. The library enables me to accomplish tasks faster.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. The library improves my ability to do research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. The library enhances my effectiveness.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. The library enables me to be more productive.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. The library makes it easier to do research.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Overall I find the library at this organization useful.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Section C. DIRECTIONS: ***For each item below, circle the number or mark the space that best reflects how you feel about the library at your facility.***

1. How satisfied are you with the library at your facility as a whole?
dissatisfied 1 2 3 4 5 6 7 satisfied
2. Overall, how would you rate the **quality of service** provided by the library at your facility?
poor 1 2 3 4 5 6 7 excellent
3. For you personally, the library at your facility is:
(***Please put a check mark in the space on each line below closest to your opinion of the library.***)

unimportant	____:____:____:____:____:____:____	**important**
relevant	____:____:____:____:____:____:____	**irrelevant**
trivial	____:____:____:____:____:____:____	**fundamental**
interesting	____:____:____:____:____:____:____	**boring**
appealing	____:____:____:____:____:____:____	**unappealing**
mundane	____:____:____:____:____:____:____	**fascinating**

Section D. DIRECTIONS: ***Please answer a few more questions concerning your use of the library at your facility. Circle your response or provide the requested information for each item below:***

1. How many times have you used or requested service from the library at your facility?
none once 2 to 5 times 6 to 10 times 11 or more times
1 2 3 4 5
2. How many times have you used the library's online catalog?
none once 2 to 5 times 6 to 10 times 11 or more times
1 2 3 4 5
3. How often do you rely on library staff when using the library?
none infrequently frequently nearly always always
1 2 3 4 5
4. Do you intend to use the library at your facility in the future?
not at all likely 1 2 3 4 5 6 7 extremely likely
5. Would you recommend others to use the library at your facility?
not at all likely 1 2 3 4 5 6 7 extremely likely

6. Age **(circle one): 25 or below 45 or below 65 or below Above 65**

7. Gender **(circle one)**: **M F**

8. Job category **(circle one): Engineer Scientist Technician Administrative Other**

Thank you for your participation.

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